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(*b*) Communicate to parties interested, also as promptly as possible, the above information.

(*c*) Indicate the wages paid for farm work.

(*d*) Make known new diseases of plants which may appear in any part of the world, showing the territories infected, the progress of the diseases, and, if possible, the remedies which are effective.

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CONTENTS

FIRST PART: ORIGINAL ARTICLES

SECOND PART: ABSTRACTS

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

II. — CROPS AND CULTIVATION.

a) GENERAL

b) SPECIAL

III. — LIVE STOCK AND BREEDING

a) GENERAL.

b) SPECIAL

IV. — Farm Engineering

V. — Rural Economics.

VI. — Agricultural Industries.

PLANT DISEASES.

I. — General Information

II. — Diseases not Due to Parasites and of Unknown Origin.

III. — Bacterial and Fungoid Diseases.

a) General

b) SPECIAL

IV. — PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

V. — INSECT PESTS.

a) GENERAL

b) SPECIAL

VI. — INJURIOUS VERTEBRATES.

The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.

ORIGINAL ARTICLES

Instruction in Agricultural Housekeeping in Belgium

by

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I. — Aim of Agricultural Housekeeping Instruction.

While the spread of agricultural instruction exercises a favourable influence on the increase of agricultural production, the special instruction of women engaged in rural pursuits tends not only to increase the material resources of the farm, but also to raise the social level and improve the general well-being of the cultivator. Is it not the duty of the farmer's wife to look after the upbringing of the children, to provide nourishing and appetizing food for the family, to keep the house in good order from an aesthetic and a hygienic point of view and to see to the general comfort of her family?

All these considerations have been taken into account in the organization of agricultural housekeeping schools in Belgium; they are not ordinary schools of domestic economy for country girls, but rather technical institutes for the training of future farmers' wives, where they acquire a knowledge of and devotion to their profession.

Agricultural instruction for girls, begun twenty-three years ago, has extended rapidly and there are indeed few countries in which this organization is so well developed as in Belgium.

These schools can be classed as permanent or fixed, and temporary or travelling.

II. — Permanent Schools.

These consist of three types: A, Agricultural Housekeeping Schools; B, Agricultural Housekeeping Sections; C, Elementary Technical Agricultural Sections.

A. Agricultural Housekeeping Schools. — There is no agricultural instruction of a higher or university standard for girls. The permanent farm schools give instruction of a secondary standard. They aim at giving a sound technical education suitable for young women intending to take up agriculture. The instruction comprises a theoretical and practical course in the following subjects: Natural History, elements of Agriculture, Kitchen Gardening and Flower-growing, the elements of Animal Husbandry, Dairying, Domestic Economy, the elements of Pedagogy and Hygiene, the elements of Commerce and Book-keeping. There are also occasionally Courses in Common Law and Social Economics.

The courses are generally divided into two years of study.

The development of this scheme, its internal organization and the relative importance of the theoretical and practical work are not the same for all schools. The scheme and detailed time-table of instruction are submitted for the approval of the Minister of Agriculture. The following is a scheme of practical work for one of the schools:

In groups of from 4 to 6 the pupils take their turn in feeding the live stock, milking the cows, calculating the feeding value and price of the rations, learning to recognise the good and bad points of live stock, making butter and cheese, and analysing the dairy products. They also take charge of the poultry-yard, superintend the hatching of chickens both artificially and naturally, and undertake the rearing of poultry, fattening of pullets and their preparation for the market. They take charge of the apiary, take the swarms, gather the honey and the wax and prepare hydromel. They grow vegetables and flowers, prune fruit-tres, prepare jams and preserved fruits, make wine and various beverages from garden fruit, and keep accounts.

In Domestic Economy they make and repair clothes, wash, bleach and iron linen, prepare meals, and are responsible for the decoration of the houses and gardens.

At these schools, the instruction is entirely free, but the pupils pay for their board. They keep a strict account of the income and expenditure of the establishment; each month an account is made out for each member, either mistress or pupil, who then contributes her share.

There are thirteen such schools in Belgium: Bastogne, Berlaer, Bouchout, Brugelete, Celles, Gortemarck, Cooreind, Gijseghem, Héverlé, Herve, Overijsche, 'S Gravenwezel, Virton, Wavre-N. Dame. With the exception of those at Bouchout and Virton all these schools are under one central institution of general instruction.

The Department of Agriculture contributes to the expenses according to the scheme of development, the value of its staff of instructors, and the importance of the station and its equipment, by subsidies varying from 1000 to 4000 francs (£40 to £160).

The age of admission for pupils is 14. To facilitate study and to avoid loss of time in taking notes the pupils are provided with type-written summaries or they make use of text-books. These are also useful for women who wish to study at home.

At the end of the course the pupils may be examined before a board composed of a delegate from the Department of Agriculture, a delegate from the province (in cases where the school is subsidised by the provincial government), and members of the staff.

To encourage attendance, the public authorities offer scholarships to pupils. The Department of Agriculture also offers scholarships to students on the application of the candidate and the recommendation of the examining board. Certain provinces include an annual allowance in their budgets for distribution as scholarships for pupils of particular schools.

B. Agricultural Housekeeping Sections. — These aim at inculcating a taste for agriculture and at the same time imparting general instruction. The course corresponds to a lower secondary standard.

The technical instruction and the practical work is more limited than in the true agricultural housekeeping schools. The scheme of work comprises elements of Agriculture, Dairying, Domestic Economy and Bookkeeping. Four hours per week are devoted to theoretical and about the same to practical work. The government subsidies amount to 750 to 1000 francs (£30 to £40) per year for each section. Sections are established at Champion, Jodoigne, Maulde, Tessenderloo and Waremme.

C. Elementary Agricultural Sections. — The foregoing courses are for girls who can put in at least one full year's study, whilst these elementary sections are intended for the children of small holders, who have to assist their parents in farm work at an early age.

In general they are in connection with public or private elementary schools and the scheme of work is capable of modification according to local conditions. Thus there are some which work only during the slack period in the farm work, others for one afternoon per week throughout the year, others in the evening or on Sundays..

Attendance at these courses is gratuitous. The Departments of Science and Arts and of Agriculture may collaborate in the organization of these sections. The former makes grants to the adult schools, while the latter gives an annual grant of 350 to 750 francs (£14 to £30) and pays half the expenditure of the necessary equipment for the course in agriculture.

Elementary sections for girls, of recent creation, are as yet only 10 in number, but it may be safely predicted that, when better known, they will rapidly increase, for they are destined to render valuable services to the rural population.

These courses are already in existence at Appelterre, Borsbeke, Hévelé, Terbanck, Iseghem, Resseghem, Rondu, Salmchâteau, Vezon, Vorst and Zeelhem.

III. — Temporary or Travelling Schools.

The temporary agricultural housekeeping schools are moved two or three times a year from one canton to another, and form one of the most interesting features of agricultural education in Belgium. When

they were started, in 1890, they immediately met with great success. These schools were originally founded for the development of the national dairy industry, and their first object was a rapid dissemination in the country districts of the best methods of utilising milk and of making butter and cheese. At present the session lasts four months, and the course comprises Crops, Live Stock, Dairying, Cheese-making, Domestic Economy, Poultry-keeping and Book-keeping.

These schools are provided on the request of the community, or of an agricultural organization or society, with the pecuniary assistance of the State, the province, the community or the agricultural society. The budget of these schools reaches about 2 500 francs (£ 100) for a session of four months.

The instruction given is theoretical and practical and the classes are held every week-day, two hours being devoted to theory and three to practical work. All the pupils are external, the maximum number not exceeding 20. Attendance at the course is entirely free.

In order to be admited to the classes, girls must comply with the following conditions : 1) age 15 ; 2) possess a good elementary education attested by a certificate ; 3) physical fitness for the work. The staff of instructors consists of 1) a director, who gives the course in Crops and Live Stock and is responsible for the organization of the school (these positions are filled by State agriculturists) ; 2) two resident mistresses, who give the courses in Domestic Economy, Dairying, Cheese-making and Book-keeping ; they also direct the practical work. The mistresses receive a fixed salary paid by the State. During the period when the schools are closed, they give lectures and public courses for farmers' wives.

For practical work, all the schools are furnished with appropriate material (separators, churns, butter-workers, refrigerators, butyrometers, cheese-making utensils, cooking utensils, lye-washers, sewing-machines, etc.).

At the end of each session an examination is held in all the branches of instruction and in practical work. The examining board consists of the staff and a delegate from each authority patronising the school. Since the foundation of these schools, more than 6 000 girls have received diplomas.

At present there are thirteen such schools in the country, distributed as follows :

Province	Number
Antwerp	2
W. Flanders	2
Brabant	1
E. Flanders	1
Liège	1
Limbourg	1
Luxembourg	3
Namur	2
Total	13

The success of these schools is generally much greater than that of the permanent ones. Owing to the scarcity of labour in the country the small or average cultivator has difficulty in sending his children to school for one or two years about the age of 15. The travelling school, lasting only 4 months, may be said almost to carry the instruction to the pupils' homes, with the result that they are more easily got together.

It is often found that when a new session is opened in a place where one has already just been held the applications for admission are more numerous, which shows that the farmers' wives appreciate the technical instruction as soon as they get to know it.

IV. — Lectures and Farm Women's Circles.

The organisation of public lectures and the creation of farm womens' circles are the most successful of all methods for the rapid diffusion of technical instruction of women in the country. They constitute a real extension of agricultural housekeeping education.

For two years the Department of Agriculture has been organising *lectures* on various subjects of interest to farm women: provisioning the household, management of the kitchen and fruit garden, preservation of fruits and vegetables, feeding of live stock, dairying, poultry-keeping, hygiene, etc. These lectures are instituted on the recommendation of State agriculturists or on request from an association of farm women. Everywhere they are accorded the warmest possible welcome, and the average attendance is as high as 70.

The *farm women's circles*, are associations of country-women, who, by means of lectures, the institution of libraries, and competitions, attempt to circulate the information necessary to the proper management of a rural household or farm. To organize a circle, a large number of members is not necessary to begin with. Very often it is sufficient to call together some old pupils of agricultural housekeeping schools and a few intelligent country-women, to explain to them the aim of the periodic meetings and to submit to them a very simple draft of rules.

If the circles wish to become proprietors of various objects, they are granted the legal form of a professional union. The resources are made up from members' subscriptions (generally very small) and from gifts of patrons. Public authorities may assist by organizing lectures, libraries and competitions.

In six years 183 circles have been formed, with a membership of 21 500. In 1912 the farm women's circles organised 806 meetings. The circles are united to form federations, three of which run journals.

V. — Conclusion.

Agricultural housekeeping instruction has rendered and still continues to render most valuable services to the agricultural population of Belgium. As yet, however, it only reaches a select few, representing less than 1 per

cent. of the girls who might profit by it. Thus it is by increasing the number of easily accessible schools and popularising the methods of scientific agriculture that improvements in the conditions of rural life and the raising of the dignity of the agricultural profession can be effected. When the farmer's wife has realised the fullness of her duty and learnt a better appreciation of rural life, and her daughters no longer seek to leave the country, the young men will be more ready to take up an agricultural life.

Present Organization of Agricultural Meteorology in Sweden

by

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The Swedish Meteorological Service in the continental part of the country is chiefly centralized at the Central State Meteorological Institute which depends, from an administrative point of view, from the Royal Academy of Sciences and has been at work since 1873. There is besides a Meteorological Observatory of the first class at Upsala depending from that University.

There is no special service for agricultural meteorology at the Central Meteorological Institute. But an endeavour has been made to organize the observations in the numerous stations, as well as their publication, and in general the whole service, in such a manner as to give satisfaction not only to the many requirements of the public in the matter of meteorological intelligence of all kinds, but also to the agricultural classes. With this object in view, the Institute has naturally tried to conform to the resolutions taken from time to time by the International Meteorological Congresses and committees.

In the interests of agriculture the Institute's activity consists in: 1) daily meteorological service; 2) regular observations of the temperature and hygrometric state of the air, direction and velocity of the wind, duration of sunshine, degree of cloudiness, rain and snowfall; 3) observations on storms, state of the ice, and on phenomena interesting the animal and vegetable kingdom and agriculture.

1.— For the daily meteorological service the Institute receives throughout the year telegrams giving meteorological observations taken in the evening and in the morning by 16 home and 68 foreign stations, in all 84. With the assistance of all these telegrams two synoptic charts are drawn up daily, the morning one being exposed to the public in five places in the capital. The most important observations contained in the morning telegrams are communicated to 9 daily papers of the capital under the form of a table, accompanied by a summary of the state of the atmosphere and by a fore-

cast for the following 24 hours. Three of the papers with the widest circulation publish meteorological charts.

The summary and the forecasts are telegraphed between 11 o'clock and noon to those communes who pay a fixed subscription for this purpose to the telegraph administration. A shorter summary, as well as the forecasts, is also sent to the managers of the State railways, who expose them to the public in all the large stations. This arrangement has also been adopted by several private railway companies. This intelligence is also communicated by telephone to private persons.

In July, August and September a special afternoon meteorological service is oganized for the benefit of agriculture. For this purpose the Institute receives during the above period the morning telegrams containing the observations made in the evening and in the morning of 6 other home and one other foreign stations, as well as the afternoon telegrams from 17 home and 19 foreign stations. The forecasts that are drawn up by means of these telegrams are published between 5 and 6 p.m.; they are hung up to the public in five places in the capital; they are communicated to the newspapers and spread like the morning intelligence by means of the telegraph and telephone.

2. — The observations on the temperature and hygrometry of the air, direction and velocity of the wind, cloudiness and amount of sunshine, are made regularly three times a day in 37 stations of the second class kept by the State, and by a small number of private stations (8 in 1912). In these stations readings are also taken of maximum and minimum temperatures, of the snow and rainfall, as well as observations on storms, hail, fog, etc. The observations of 18 stations are published in full in the collection called "Swedish Meteorological Observations", published since 1859, with a new series since 1873; those of the other stations are given under the form of annual tables. In this publication the monthly reports of about a hundred private stations of the third class (about which more below) are inserted.

A network of stations of the third class, for the most part private, has existed since 1878, especially for rainfall reading and also for observations on the temperature of the air, and if to these be added about 40 stations in lighthouses in which the amount of rainfall and temperature are observed, as well as the hydrographic stations which have been established during recent years, a total of 633 raingauge stations is reached for the year 1912. The quantity of monthly rainfall, the maximum for 24 hours, as well as the number of days with rain, snow, storm and frost (minimum below freezing point) are noted in the periodical bearing the title "Swedish Monthly Meteorological Bulletin in the Interests of Agriculture" (33rd year, 1913). Each number contains a chart showing the quantity of rainfall, and a certain number of tables on the temperatures of the air and the soil, and the winds, besides communications from observers, etc.

3. — Besides the observations mentioned above and which are mainly made by instruments, several persons observe certain phenomena which are of interest to agriculture (storms and the state of the ice), as well as phenomena in the vegetable and animal kingdoms (phenological observa-

tions) and in agriculture. Night frosts dangerous to vegetation were equally noted by these observers; at present they are set forth (since 1881) in the monthly bulletins of a certain number of rainfall stations. This system of stations, called fourth class stations, was organized in 1871 by Professor H. H. Hildebrandsson at Upsala, and was adopted in 1881 by the Central Meteorological Institute. Nevertheless, owing to want of funds wherewith to pay them, the observers of phenomena in the vegetable and animal kingdoms are now not numerous.

Besides the periodicals mentioned above as works that may be important to agriculture from the meteorological point of view, the following may be noticed.

H. E. HAMBERG. La température et l'humidité de l'air à différentes hauteurs observées à Upsal pendant l'été de 1875. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1876, 37 pages, 1 pl. Upsala, 1876.

H. H. HILDEBRANDSSON. The storms in Sweden 1871 - 1875 (in Swedish). Supplement to the *Mémoires de l'Académie Royale des Sciences de Suède*, VI, No. 13, 22 pages, I pl. Stockholm, 1877.

H. H. HILDEBRANDSSON and C. A. RUNDLUND. Prise et débâcle des lacs en Suède, automne 1871-printemps 1877. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1878, 8 pages, 3 pl. Upsala, 1879.

H. W. ARNELL. The Development of Vegetation in Sweden from 1873 to 1875 (in Swedish). — *Annales de l'Université d'Upsal*, 1878, pages 84, 3 pl. Upsala, 1878.

H. H. HILDEBRANDSSON. Marche des isothermes au printemps dans le nord de l'Europe. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1880, 10 pages, 3 pl. Upsala, 1880.

A. C. HÖGBOM. Marche des isothermes en automne dans le nord de l'Europe. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1883, 8 pages, 4 pl. Upsala, 1883.

H. E. HAMBERG. De l'influence des forêts sur le climat de la Suède I-V. Supplément du rapport de l'Administration des Domaines sur les forêts, Années 1884, 1887, 1895 (in Swedish and in French). I et II: Organisation et température, 76 pages, 1 pl.; III: Humidité de l'air, 58 pages, 1 pl.; IV et V: Eaux tombées, et couche de neige, 128 + 36 pages, 18 + 12 pl. Stockholm, 1885, 1889, 1896.

H. MOHN and H. H. HILDEBRANDSSON. Les orages dans le peninsule scandinave. — *Nova Acta Reg. Soc. Sc. Ups.*, Series III, 1887, 55 pages, 12 pl. Upsala, 1888.

H. E. HAMBERG. Die Sommernachtfröste in Schweden 1871-1900. — *Mémoires de l'Académie Royale des Sciences de Suède*, Vol. 38, No. 1, 94 pages, 5 pl. Stockholm, 1904. — The memoir contains also average dates for certain epochs in the development of vegetation, especially in their bearing on agriculture.

H. E. HAMBERG. Moyennes et extrêmes de la température de l'air en Suède 1856-1907. Supplément aux Observations météorologiques Suédoises publiées par l'Académie Royale des Sciences de Suède, Tome 49, 2e série, Vol. 35, 1907, 81 pages, 20 pl. Upsala, 1908.

H. E. HAMBERG. Les Pluies en Suède de 1860 à 1910. — Supplément aux *Observations Météorologiques Suédoises*, Vol. 52, 1910, 215 pages, 16 pl. Upsala, 1911.

Composition and Agricultural Value of the Arable Lands in the Argentine Republic.

Part I: Provinces of Buenos Aires and Santa Fé.

by

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GENERAL CONSIDERATIONS.

The vast territory of the Argentine Republic, estimated at 1 139 800 square miles, extends from 21° to 54° S., that is to say from the tropics to the southern cold zone. It possesses a mountain system occupying a relatively limited area; this consists of the great mass of the Andean Cordillera, the principal summits of which mark the boundary line on the west between Argentina and Chile.

Apart from the important groups of mountain chains connected with and nearly parallel to the system of the Andean Cordillera, which occupy the provinces of Jujuy, Salta, La Rioja and a part of Tucuman in the north, only a few isolated massifs occur in this immense country; such are those in the centre of the country in the north of the provinces of San Luis and Cordoba and some sierras of less importance in the south of the province of Buenos Aires. The rest of the country consists of immense plains called "pampas", the monotony of which is only relieved in certain districts by slightly elevated undulations, or in the more sandy regions by some dunes fixed by vegetation or by others still shifting.

The alluvial soils of which these plains are formed sometimes attain a considerable depth, as in the north and centre of the province of Buenos Aires and the south of Santa Fe and Cordoba; no pebbles occur in them, and most of them, at least in the upper strata, contain no "fine gravel"; it is only in exceptional cases that the whole of the soil will not pass through a 1 mm. sieve. They are in general rather fine soils, the "coarse sand" being almost always inferior in quantity to the "fine sand;" the clay content is very variable, and in consequence the soils vary from very heavy to very light, and some are even shifting.

A good idea of the distribution of the soils in the most cultivated part of the country—the part which we are going to describe (1)—may be had by

(1) It comprises the provinces of Buenos Aires, Santa Fe and Córdoba, the Pampa territory, and the provinces of San Luis, Mendoza, San Juan and Santiago del Estero, or a total of about 300 million acres.

starting from Buenos Aires and turning towards the west, following for example the Pacific railway which crosses the country almost in a straight line for a distance of about 650 miles ; in a belt along the coast the soil is found to be fairly heavy, becoming gradually lighter as the boundary between the provinces of Buenos Aires and Cordoba is approached ; in the south of this province and in the province of San Luis it becomes sandy, as it does also, though to a lesser degree in that of Mendoza. It is the same in going from Buenos Aires into the south-west of the province and as far as the Central Pampa, but matters change on travelling northwards parallel to the Rio Parana ; thus the somewhat heavy soils of the south of the province of Santa Fe become stiffer towards the north of the same province ; they are then clay soils, sometimes even plastic clays, such as are met with also in a great part of the Chaco and of Formosa, regions covered with forests, particularly of " Quebracho colorado ".

Province of Buenos Aires.—The province of Buenos Aires, by far the most inhabited and the most highly cultivated of the whole Argentine, has an area of about 75 million acres, of which some 17 per cent., or 12 850 000 acres (1) are sown to wheat, oats, maize and flax, which are the chief crops of the country. Though the rest of the country is covered with natural grassland or put down to lucerne (2) and is kept chiefly as grazing land, it must be mentioned that there are many soils suitable for arable farming and that only a small part of the lands capable of yielding abundant crops are at present under the plough. Nevertheless every year the acreage of tilled and sown land increases to a remarkable extent; but it must also be said that a good many soils which are too light and unsuitable to wheat are cultivated and this, together with unsufficient tillage, contributes in a large measure to lower the general average of yield.

The production of cereals is by no means uniformly distributed throughout the province ; it is on the contrary pretty much restricted to a belt bounded on the north and west by the provinces of Santa Fe and Cordoba, and on the south and south-west by a line slightly curved to the south, which, starting from a point somewhat lower than Buenos Aires, makes an angle of about 60° turned to the south with the meridian of the above town. In fact, out of the 9 400 000 acres under wheat, flax and oats in this province, 4 570 000 belong to this belt, which includes a total area of about 21 550 000 acres. Wheat alone accupies 2 565 000 acres, while oats has 885 000 and flax 1 194 000 acres ; if to these crops be added maize, which in the whole province is grown on 3 460 000 acres, of which 70 per cent. or 2 430 000 acres belong to this belt, the cultivated area of the belt amounts to 36 or 37 per cent. of its total acreage.

These figures show clearly that the province of Buenos Aires may be divided into two parts : one comprising the northern and north-western

(1) These figures are published by the Board of Statistics and of Rural Economics of the Ministry of Agriculture and correspond to the crops of 1911-12.

(2) There are about 5 million acres under lucerne in the whole province.

belts prevailingly devoted to field crops, of which we have above roughly sketched the boundaries, whilst the other more southern and much larger part, 52 585 000 acres in extent, is chiefly devoted to live-stock breeding. Of this area only 4 870 000 acres are sown to wheat, oats and flax, and 1 030 000 to maize, or a total of 5 900 000 acres, which amounts to only 11 per cent. of the whole acreage of the southern belt.

This distribution of agriculture in the province under discussion depends evidently to a great extent upon the nature and composition of the soil and subsoil; the best soils for crops are undoubtedly to be found in the northern part.

The alluvial beds in this belt are of great depth; the subsoil consists of yellowish or gray clay, mixed in variable proportions with silicious sand, not very permeable, which however weathers easily in contact with the air and rapidly gets loosened by tillage; it possesses the peculiar characteristic of permitting vertical cuttings to be made in it without any danger of caving in. The wells in this belt, and there are some which are quite ancient, have been excavated to depths which attain 80 feet and have never been lined with masonry. On this clay, which sometimes contains small quantities of gypsum, rests a black humiferous layer 24 to 32 inches deep. This layer is not homogeneous; the arable soil for a depth of 12 to 20 inches is in general less compact than the underlying stratum; the latter (or subsoil) is often very compact, and is in any case more clayey and consequently less permeable than the surface soil. The particles forming these two layers, which are the ones of special interest to the farmer, are very fine.

According to numerous analyses made, following Schloesing's method, at the Laboratory of the Ministry of Agriculture, and upon which this paper is based, samples from the upper layer to a depth of about 12 inches show a proportion of sand varying between 70 and 82 per cent. and of clay (silt and clay) between 12 and 25 per cent. They are somewhat heavy soils, which however can be ploughed without difficulty, even those which contain the most clay. They are for the most part sufficiently permeable; their colour when they are dry varies between gray and deep gray according to the quantity of humus present, which frequently amounts to 25 and 35 per cent. and often corrects the defects due to the excess of clay.

In general these soils are well provided with the elements of fertility; nitrogen, potash and phosphoric acid, though of the latter the content of these soils is frequently below 1 per thousand; they are all poor in lime, the maximum not exceeding 10 to 12 per thousand, of which about two-thirds is soluble in 2 per cent. nitric acid in the cold. In spite of their low lime content and the presence of large quantities of humus, these soils present in general an alkaline reaction to litmus paper; this is often due to the solubility of the very basic alkaline silicates that they contain. On the other hand, the presence of these alkaline salts in the soil contributes to render it more compact; it has then a marked tendency to pack under the action of the rain.

It is doubtless also partly due to the comparatively ready decomposition of these silicates that sodium bicarbonate is present in almost all the under-

ground waters and in many superficial ones (lagoons or "arroyos") in which the carbonate is also found.

Summing up, one may say that if it were a question of improving this soil, the addition of lime would be advisable as it would produce excellent effects. As for manures, the use of which is extremely limited in the country, the most advantageous would be phosphates, especially under the form of basic slag.

The subsoil in many cases lacks permeability, the result being that depressions without natural outlets get converted into more or less permanent sheets of water; this could easily be avoided by providing an outlet for the rainwater.

It is especially in the belt near the Rio de la Plata, to the south of the Federal capital, that these facts are observed, because the amount of clay in the soil and subsoil diminishes as one proceeds westwards. As a further illustration, we give in Table I some analyses of good soils of the northern and north-western belt.

Anyhow, in the greater part of this belt the soil presents no serious difficulty to tilling operations, and the permeability of the subsoil, somewhat defective in the most clayey parts, improves considerably on being suitably worked. These soils, on account of their physical characters and geographical position, will certainly be the first to be submitted to the intensive cultivation of cereals and flax. It must also be taken into account that they are entirely within the belt corresponding to 800 and 600 mm. (31.5 and 23.6 inches) of yearly rainfall.

At present the average yield of wheat is about 12 bushels (of 60 lbs.) per acre in the north of this belt and reaches 15 bu. in the rest; these yields, the former especially, are not high, but it must be remembered that we are dealing here with extensive cultivation, upon which is bestowed the least possible amount of labour and no manure. In the most northern part of this belt about one-fifth of the acreage under wheat attains an average yield of 22 bu. per acre; whilst in the most southern part this yield is given by about one-third of the land under wheat, and on one-eighth of the area it even reaches 30 bushels.

Besides cereals, this belt is very suitable to the production of fruit, especially dessert grapes, and of vegetables, for which for a fairly great distance round Buenos Aires and other centres of population there would be no lack of manure, which is only now beginning to be used and that to a very limited extent; but in these somewhat compact soils, poor in lime, abundant manuring would not be advantageous unless a fairly abundant liming were previously resorted to. The rest of these lands form good natural grass devoted to grazing. Notwithstanding their relative poverty in lime, lucerne gives excellent results; it is really the only forage plant that is grown in the country, succeeding in almost every locality in which the rains or the natural moisture of the soil are sufficient.

To the south of the line, which for lack of natural landmarks we call the limits of the northern belt, the rest of the province of Buenos Aires may again be divided into two parts: a central one which includes about 20 558 800

TABLE I. — *Analyses of Soils. Province of Buenos Aires. North and North-west belt.*

	I		II		III		IV			V		VI	
	S Brown	S' Yellowish brown	S Brown	S' Yellowish brown	S Brown	S' Yellowish brown	S Brown	S' Yellowish brown	S'' Yellow	S Dark gray	S' Yellowish gray	S Dark gray	S' Yellowish gray
Fine gravel . . . . %	0	0	0	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . »	17.10	9.50	2.66	2.07	42.10	38.10	13.20	2.80	6.00	25.20	26.70	55.51	63.27
Fine sand . . . . »	55.20	56.70	77.56	70.98	41.10	40.20	74.00	51.20	61.20	58.10	48.40	30.10	24.90
Total sand . . . »	72.30	66.20	80.22	73.05	83.20	78.30	87.20	54.00	67.20	83.30	75.10	85.61	88.17
Clay . . . . »	24.60	31.70	17.30	24.40	12.60	18.60	10.20	41.80	29.70	12.40	23.30	7.95	9.31
Humus . . . . »	0.80	0.20	1.40	0.80	3.00	0.80	0.90	0.70	0.20	3.00	0.50	2.20	0.50
Organic detritus and soluble matter »	2.30	1.90	1.08	1.75	1.20	2.30	1.70	3.50	2.90	0.40	0.60	4.25	2.02
Nitrogen . . . . ‰	1.48	0.76	3.12	1.34	2.66	1.06	1.81	1.25	0.62	2.51	0.99	1.94	0.80
Total lime (CaO) . . . . »	5.80	5.46	7.11	5.46	9.74	8.23	4.10	4.26	11.65	8.20	6.73	7.76	6.41
Soluble lime . . . . »	3.98	3.92	5.32	3.86	5.43	3.75	1.96	2.41	7.50	2.86	3.58	1.75	2.32
Potash (K_2O) . . . . »	7.82	8.19	4.96	5.64	4.79	5.18	5.83	11.34	11.54	5.87	6.62	3.82	3.40
Phosphoric acid . . . . »	1.29	0.81	1.71	0.88	1.32	0.75	0.88	1.12	1.60	1.50	0.82	1.13	0.50

S = Soil — S' = Subsoil — S'' = Second subsoil.

acres, of which 3 169 900 acres or 15.4 per cent. are under cereals: wheat 2 005 600 acres, oats 649 600, and maize 513 750 acres; hardly any flax is grown.

The characters of the arable lands of this central region resemble those of the neighbouring belt which we have described, but they become gradually lighter, especially towards the south and south-west. Some analyses giving the composition of these soils and subsoils, as well as their content of fertilizing elements, are given in Table II.

Many of these soils may be classed as good loams, the others as light, that is they are very easy to till and very permeable. The average yield of wheat is very low, rarely above 7.7 bushels (of 60 lbs.) per acre. These soils are nevertheless well provided with the elements of fertility excepting phopshoric acid, the amount of which is frequently inferior to 0.80 per thousand. They are also poor in lime, rarely containing more than 10 per thousand. The arable soil rests on a subsoil much less compact than in the north-western belt, and which often differs but little from the soil and is consequently very permeable. Nevertheless, if one examines the map of this region, as well as that of the sea-coast of which mention will be made further on, one is struck by the number of more or less permanent lagoons scattered over the surface. Almost all of these lagoons are due to the presence of an interrupted bed, without any appearance of stratification, of a kind of pan, called "tosca" in the country; it is an impermeable concretion, more or less ferruginous and containing lime, generally thin, but some times attaining a thickness of 16 feet. It is situated at varying depths and frequently in low-lying parts crops out at the surface. This formation (1) is rather widely distributed in the country; it exists also in the northern belt, but often at a certain depth, forming in the gray and yellow clays discontinuous lenticular areas upon which the water accumulates, forming the first sheet of underground water. The belts in which "tosca" is at a slight depth are only adapted to natural grassland; in the other parts lucerne grows very well.

Though live-stock breeding will prevail in this region, there are many soils in it suitable for growing cereals, as well as potatoes, which do admirably in the lighter parts.

In the rest of the province, that is the part along the Atlantic, whose area may be estimated at 32 million acres, only about 2 ½ million acres are sown to cereals. This is the region of sandy soils, with but slight cohesion, some of them shifting sands, as towards Bahia Blanca.

These lands are mostly covered with natural grassland and lucerne fields; the latter are found wherever the depth of the soil and of the subsoil allow it, in the higher parts of the undulations, where the "tosca" is at a sufficient depth not to interfere with the root development of the plants.

Such are in broad lines, the principal characters of the soils and subsoils encountered in the province of Buenos Aires. But it will be easily

(1) It constitutes one of the characteristics of the Pampean system.

TABLE II. — *Analyses of soils. Province of Buenos Aires: South-west and south region.*

		I		II		III		IV		V	
		S Grayish black	S' Gray	S Dark brown	S' Yellow	S Light brown	S' Yellowish brown	S Grayish brown	S' Yellowish brown	S Black	S' Yellowish brown
Fine gravel	%	0	0	0	0	0	0	0	0	0	0
Coarse sand	»	23.70	34.20	49.80	64.40	78.80	83.00	26.90	21.90	10.80	14.20
Fine sand	»	61.44	50.84	39.60	29.00	16.30	12.10	60.70	59.70	67.17	61.48
Total sand	%	85.14	85.04	89.40	93.40	95.20	95.10	87.60	81.60	77.97	75.68
Clay	%	9.90	13.50	4.30	6.00	3.60	4.10	10.60	16.00	19.00	22.90
Humus	»	3.20	0.60	3.00	0.10	0.50	0.20	1.60	0.60	2.60	0.60
Organic detritus and soluble matter	»	1.70	0.86	3.30	0.50	0.70	0.60	0.20	1.80	0.43	0.82
Nitrogen	‰	3.13	0.75	3.32	0.50	0.73	0.56	2.59	1.12	2.86	1.08
Total lime (CaO)	»	4.76	3.84	7.81	5.81	6.83	6.83	6.94	7.00	11.79	15.82
Soluble lime	»	4.69	2.45	3.98	1.12	1.96	1.74	3.36	3.36	6.65	10.15
Potash (K_2O)	»	4.22	2.34	4.22	4.08	3.02	3.04	4.08	5.03	5.44	6.77
Phosphoric acid	»	1.44	0.55	1.13	0.32	0.95	0.82	0.77	0.46	1.46	1.10

S = Soil. — S' = Sub-soil.

understood that the limits of the areas covered by these various types, which we have just described, cannot be given otherwise than approximately. In this immense plain the changes in the characters of the soil are far from being sharply distinguished from each other like soils resting on the geological formations from which they are derived; we will add that there are no areas of any importance which contain only one and the same type of soil. As we have already observed at the beginning of this paper these are alluvial soils, the mineralogical constituents of which have not, as far as we know, been investigated, but which seem to present very slight differences from one point to another, but which from an agricultural point of view differ in their greater or lesser content of clay and also of humus, that is to say chiefly in their degree of cohesion and of permeability, which change gradually from one point to another.

Province of Santa Fé. — It is needless to say that the boundaries of the provinces do not constitute limits to the types of soil; these are almost always the same in the borders of neighbouring provinces; thus in the south of the province of Santa Fé on the northern boundaries of the province of Buenos Aires, the arable lands are similar to those of the northern belt of the latter. These lands in the province of Santa Fé form a total of 12 972 500 acres, of which about 53 per cent. are sown to wheat, oats, maize and flax. The total area of this province is estimated at 32 450 000 acres, so that that under cereals and flax is about 7 336 000 acres, of which 6 847 000 acres, or 93 per cent., belong to the southern belt.

Here also, on a considerable depth of alluvial soil of the same nature as those already described, the same humus layer, sometimes 3ft. deep, is found; with it occurs a somewhat heavier superficial layer on a more compact subsoil containing more clay; these characters are still more marked along the Rio Parana, and diminish towards the west and south-west.

Like the north and west of the province of Buenos Aires, the southern part of that of Santa Fé is one of the oldest under cultivation; as an example of the composition of its soil and subsoil some analyses are given in Table III.

The analogy between these soils and those of the neighbouring belt is evident; they are likewise generally well provided with humus, nitrogen and potash, with perhaps a somewhat lower content of phosphoric acid, but they are all poor in lime.

In general, under this arable layer, about one foot or more deep another blackish layer is found: this contains more clay and is often but little permeable, but becomes more so on going towards the north. Nevertheless, in the northern part of this province there is also a fairly important area in which the soil, of average or slightly heavy nature and sometimes even very light, rests on a very clayey and almost impermeable subsoil, containing 38 to 45 per cent. of clay (silt plus clay).

In the most northerly part of this same province, bordering on the Chaco, are found only blackish or gray, more or less deeply coloured, very plastic clays, which crack on drying and become very hard; these lands cannot be used except for grazing. These two belts represent about 19 478 000

TABLE III. — *Analyses of soil. Province of Santa Fé.*

	I		II		III		IV		V	
	S Reddish brown	S' Reddish brown	S Dark gray	S' Yellowish gray	S Yellowish grany	S' Yellow	S Gray	S' Yellowish brown	S. Gray	S' Grey blaek
Fine gravel . . . . %	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . »	18.50	14.20	10.90	13.00	4.60	2.30	2.20	1.30	3.40	2.50
Fine sand . . . . »	59.00	42.40	69.50	57.40	66.60	56.70	82.53	61.14	47.84	48.86
Total sand	77.50	56.60	80.40	70.40	71.20	59.00	84.73	62.44	51.24	51.36
Clay . . . . »	20.00	41.30	17.00	27.00	25.90	38.70	12.50	35.40	47.00	46.40
Humus . . . . »	1.50	0.10	1.20	0.70	0.90	0.30	0.50	0.20	1.10	0.50
Organic detritus and soluble matter . . »	1.00	2.00	1.40	1.90	2,00	2.00	2.27	1.96	0.66	1.74
Nitrogen . . . . ‰	1.60	1.15	2.93	1.37	1.30	0.74	0.98	0.69	2.16	0.49
Total lime (Ca O) . . . . »	5.40	6 97	8.85	7.00	6.92	8.40	3.53	5.91	4.84	3.64
Soluble lime . . . . »	3.47	4.98	5.54	3.86	3.86	5.21	2.38	3.50	3.64	2.59
Potash (K_2O). . . . . »	6.20	7.33	7.54	7.22	6.21	6.93	6.53	10.06	9.05	9.54
Phosphoric acid . . . . »	0.94	0.94	2.45	1.38	1.21	1.29	0.51	0.78	1.00	0.77

Analyses Nos. I, II, III: Southern part; No. IV: Central part; No. V: Northern part. — *S* = Soil. *S'* = Subsoil.

acres, of which about half belongs to the intermediate belt which is cultivable at many points.

The provinces of Buenos Aires and Santa Fé are especially favoured on the one hand by their geographical position in proximity to the Parana and La Plata rivers, which border their greatest length, and on the other by their climatic conditions, which ensure them an abundance of rain equally distributed throughout the whole year, so that they do not need irrigation ; there exists here an unbroken area of nearly 34 ½ million acres of very good soils suitable for most crops, and which, in order to yield good harvests and satisfactory economic results, do not in general require for the moment anything beyond tillage suitable to the nature of the soil and subsoil.

Of course, as has been stated, there are also lands exhausted by an exclusive and continuous production of wheat and flax during many years (20 or 25 years and even more) without any manuring; but a more systematic farming, and the use of green manuring in default of other manure, would soon change this state of things, especially if liming were resorted to, using for the purpose the deposits of limestone which are found in large quantities near the Rio Parana on the shore opposite Santa Fé, near the city of this name, without mentioning the important beds of small mollusc shells which have accumulated chiefly along the banks of the Rio de la Plata.

Anyhow, these exhausted lands occupy only a relatively limited area when compared with that which remains to be or has only recently been brought under the plough.

To this vast extent of 34 ½ million acres must be added another and not less interesting one which forms the central part of the province of Buenos Aires and comprises 20 560 000 acres. It also includes some good soils, which, though generally lighter than those of the north-western and northern belts, are capable of giving good crops of cereals. This is a region of mixed farming, that is including live-stock breeding and dairying, whilst further south, along the coast up to Bahia Blanca, breeding will always prevail.

The intermediate belt of the province of Santa Fé is at present but little cultivated ; it could, however, be profitably cropped in many places where the soil is deep enough and the subsoil less impermeable, if it were not for the almost absolute lack of superficial and subterranean water suitable for human and animal consumption (the water found even at great depths being brackish). This is general throughout this region up to the Chaco (Chaco Santafecino) and in the neighbouring one, both to the south-west in the province of Santiago del Estero (Chaco Santiagueño) and to the north-west in that of Salta (Chaco Salteño).

The Study of Agricultural Geology in Italy

by

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The object of this paper is to give a brief account of what has been done in Italy in the geological investigation of the soil, to form an introduction to the bibliography which follows.

In this paper and in the bibliography, agricultural geology is taken only in connection with the study of the soil; thus everything concerning the water supply, and especially the underground water, is excluded. This subject is of the greatest importance for agriculture, and forms a part of a distinct chapter of applied geology. It may be treated separately.

With this attempt at grouping together everything that has been done in Italy in the matter of geological research in connection with agriculture, I do not claim to have drawn up a complete survey and bibliography. Thus, for instance, I have deliberately excluded those works of a too markedly chemical character (1), all the general geological descriptions in which the agricultural conditions of the regions described are considered, but too incidently, and lastly all strictly phyto-geographical works (2).

Italy had given some fine examples of the application of geology to agriculture in Gemellaro's works (Bibl. 46), which date back to 1825, if indeed the classical works of Filippo Re, though prevailingly agricultural, be not taken as the earliest, for Re already in 1809 demonstrated the importance of the study of the soil.

The above were followed, still early in the nineteenth century, by the works of Giuli (Bibl. 51), Cuppari (Bibl. 19-22), and Savi (Bibl. 84,85). Then for a long time no geologist took interest in agriculture, nor were there agriculturists sufficiently versed in geology to apply this science with advantage to the study of the soil, which during this period had remained the undisputed domain of agricultural chemists, who enriched it by important contributions.

About 1890 the study of agricultural geology began to be taken up again in Italy, thanks to the professors of agriculture and to the agricultural

(1) Such as the following works:

SESTINI F.: Il terreno agrario. — *Enciclopedia agraria italiana.* Turin, 1899.

SESTINI, F.: Materiale per una carta chimico-agronomica dei terreni della pianura pisana, ecc. — *Atti Soc. Tosc. Sc. Nat.*. Pisa, 1903.

(2) Such as the fine general part of L. M. GORTANI'S work: *Flora della Carnia.* Udine, 1904.

institutions and associations, among which the following deserve especial mention: the Association of Italian Agriculturists, the Royal Academy of the Georgofili, the Agricultural Society of Friuli, and the Antiphylloxera Association of Brescia. From this period a fairly abundant and very important literature on the subject begins to flourish.

As may be seen from the annexed bibliography, the Italian works on agrogeology may be divided into various groups.

For educational purposes some treatises were and still are used. Besides the older works (Bibl. 18, 44), in 1898 Parona's book (Bibl. 69) appeared; in this the general geological part, always treated with special reference to agriculture, is followed by interesting information on the soils of the several provinces of Italy, some of it compiled by the writer himself, the rest being due to his collaborators (Bibl. 5,38). This work has remained up to the present the only source from which a general idea of the soils of the several regions of Italy could be drawn.

A second and more recent compendium (Bibl. 114) is of a different type. being a guide to the course of agricultural geology held in the Royal College of Perugia. Besides treating of the soil, it treats also of the waters, because in the opinion of the writer pedology and hydrology form an intimately connected whole and make up the real agricultural geology.

The good handbook (Bibl. 116) of Vallardi's agricultural library devotes itself more to the soil (1).

The monographs on the agricultural geology of individual regions are numerous. Among these, that on the Montello (2) is excellent (Bibl. 91); very praiseworthy also are those which describe the soils of Friuli (Bibl. 35, 41, 42, 101 and 102), those of Brescia (Bibl. 16, 17), of the territory of Grotte di Castro (nr. Viterbo, prov. Rome) (Bibl. 66) of Rosignano marittimo (prov. Pisa) (Bibl, 110), of Casalina (prov. Perugia) (Bibl. 12).

Nor are studies on our colonies wanting. One on the soil of Benadir appeared this year (3), while from the same author a work appeared some time ago on some soils of Eritrea. The soils of Lybia have already been the subject of some studies (Bibl. 58, 113, 119, 120), among which the principal is that on the soils of Tripoli due to a commission appointed by the Government, which confirmed what the writer had already demonstrated in 1903 (Bibl. 113), namely that the so-called desert round the oasis of Tripoli consists of the same types of soil which form the oasis itself and cannot therefore be considered as a real desert, but must be looked upon as cultivable land.

Geology has been called upon also in the land registration work. Already the old land registration contained brief notices on the nature of

(1) Completed from the hydrological point of view by the following work: PRINCIPI, P. *Idrologia agraria*. Milan, 1912.

(2) A wooded district near Montebelluno, prov. Treviso. *(Ed.)*.

(3) PRINCIPI, P. Osservazioni sui terreni agrari della Somalia italiana. — *Giorn. Geologia italiana*. Parma, 1913.

the Italian soils. On the reorganization of the office of agricultural statistics by Ghino Valenti, it was ordered that every agricultural region in the land register should be accompanied by summaries of the geological formations which make up the region. Surveys accompanied by such notices have already appeared for Latium, the Marches and Umbria (Bibl. 57), while those of Lombardy, Tuscany and Piedmont are in the press.

Geology has also been used as a base in the valuation for land registration, but works of this kind are not numerous, being limited to one on the province of Verona (Bibl. 64) and one on that of Cuneo (Bibl. 59).

A very important subject, that of agrogeological maps, has recently been much discussed and treated in Italy. Stoppani and Taramelli also called the attention of the Government to the matter, and in 1880 proposed a bill for the preparation of these maps. In 1896 the Society of Italian Agriculturists took up the question with energy. The Geological Bureau, however, being occupied with the surveys for the geological map of Italy, could not undertake this new work, and so the matter of the State agrogeological maps was allowed to drop. There were, it is true, several praiseworthy attempts on the part of Associations (Bibl. 15-17) and of private persons (Bibl. 3, 6, 12, 13, 35, 41, 42, 66, 91-93, 101, 102, 104, 105, 108, 110), who draw up valuable maps on their own account. But, as could have been foreseen, these maps were wanting in the uniformity which could only be given by an official scientific commission, and they turned out very unequal owing to the different views of the various authors or to the objects for which they were made. But this is no great harm, because when the organization of the agrogeological map, which becomes a necessity, is undertaken, several types of maps will have already been tried and among these a judicious choice can be made.

After all, the general criteria for drawing up these maps have been amply discussed (Bibl. 1, 71, 78, 79, 90, 99, 111, 112, 121, 122, 124), so that it will be fairly easy to unify the manner of setting forth the data to be shown by the maps.

Without actually drawing up the maps, several writers have contributed important descriptions of the agrogeological conditions of the various regions of Italy (Bibl. 4, 8, 24-26, 36, 37, 39, 46, 49, 50, 53, 60, 62, 63, 68, 72, 73, 82, 87, 89, 94-98). Nor have important purely scientific researches (Bibl. 27, 31, 75) on interesting questions on the soil and its behaviour been wanting.

In conclusion, it may be said that there is no branch of agricultural geology which has not been more or less extensively treated of in Italy.

The renewed interest in agrogeological study in Italy coincided with the increased importance of the teaching of agricultural geology. It had been considered as a subject of secondary importance in the various Agricultural Colleges and it was taught by the same professors as mineralogy. The College of Perugia was the first to establish an independent course of agricultural geology and mineralogy, which soon became geology and lithology and which is now simply agricultural geology. The example of Perugia was more or less faithfully followed by the other Colleges,

and the new Forestry Institute of Florence has a chair of geology applied to forestry. On this subject also several works have appeared (Bibl. 10, 11, 29, 33, 52, 85, 123).

The new chair and those of the Agricultural Colleges are occupied by capable scientists, young and promising men, so that their labours, completed by that of the Government and of the local bodies, warrant us in trusting that in the field of agricultural and forest geology also Italy is in a fair way to occupy the position which is due to her and which it is her duty to occupy soon.

Bibliography of agricultural geology in Italy, 1825-1912.

1. AICHINO, C. — A proposito delle Carte agronomiche in Italia. — *Eco dei Campi e dei Boschi*, IV. Rome, 1897.
2. BARELLI, V. — Osservazioni sulla memoria intitolata: Della torba, della sua importanza e della maniera di coltivare le torbiere. Turin, 1827.
3. BARETTI, M. — Geologia della provincia di Torino (Carta lito-agrologica, Carta agrologica). Turin, 1893.
4. BELLINZONA, G. — Il circondario di Lodi. - *Atti inchiesta agraria*. Rome, 1912.
5. BONARELLI, G. — Cenni Geologico-Agrari sull'Umbria (in PARONA: Il terreno). *Nuova Enciclopedia Agraria italiana*. Turin, Unione Tipografico Editrice, 1893.
6. BOREA, E. — Carta agronomica del circondario pavese. Pavia, 1898.
7. BORTOLOTTI, C. — Osservazioni sopra alcune terre coltivabili nel Friuli. - *Giorn. Geolog. pratica*. Genoa, 1903.
8. BRUNO, C. — Sulla costituzione del terreno e sul clima del circondario di Mondovì. Mondovì, 1871.
9. CACCIAMALI, G. B. — Sui saggi di terre vergini. — *Boll. Soc. geol. it.*, XX. Rome, 1901.
10. CANAVARI, M. — Rapporto sulle condizioni geologiche del comune di Calci in relazione alla legge forestale. Printed by Mariotti, Pisa, 1896.
11. CANAVARI, M.— Secondo rapporto sulle condizioni geologiche del comune di Calci in relazione al vincolo forestale. Printed by Nistri, Pisa, 1902.
12. CANAVARI, I. — La carta geoagronomica di Casalina (Perugia). — *Mem. Soc. tosc. Sc. nat.*, XXIX. Pisa, 1912.
13. CAPOBIANCO, G. — Abbozzo di carta geol. agraria dell'Agenzia coltivazione tabacchi di Foiano della Chiana (Arezzo). Scafati, 1901.
14. COMES, O.—Le lave, il terreno vesuviano, e la loro vegetazione. Naples, 1887.
15. COMIZIO AGRARIO DI CUNEO. — Carta agronomica del Comune di Cuneo. Cuneo, 1903.
16. CONSORZIO ANTIFILLOSSERICO BRESCIANO. — Studio Geologico-Viticolo della parte Bresciana dell'Anfiteatro morenico Benacese. Printed by Lenghi e C., Brescia, 1908.
17. CONSORZIO ANTIFILLOSSERICO BRESCIANO. — Studio Geologico-Viticolo dei Terreni delle regioni della Provincia di Brescia dove più estesamente è coltivata la vite, I-III. Printed by Lenghi e C., Brescia, 1909-1910.
18. COSSA, M. — Il terreno coltivabile. — *Enciclopedia agraria italiana*, II, 3, p. 57. Turin, 1880.
19. CUPPARI, P. — Le geogenia agraria della pianura pisana. —*Atti Accad. Georgofili*, Vol. 27. Florence, 1849.
20. CUPPARI, P. — Sulle colmate. — *Atti Accad. Georgofili*, Vol. 28. Florence, 1850.
21. CUPPARI, P. — Alcune principali condizioni del suolo italiano nelle loro attinenze con l'economia rurale. — *Atti Accad. Georgofili*, N. S., X. Florence, 1863.

22. CUPPARI, P. — I terreni considerati dall'aspetto agrario. — *Nuova Antologia*, XI. Rome, 1869.
23. D'ANCONA, G. — Della chimica composizione degli scisti galestrini e di una prova di debbio in essi eseguita. — *Atti Soc. tosc. Sc. nat., Memorie*, XVI, p. 24. Pisa, 1897.
24. DA RIO, N. — Geologia, idrografia, agricoltura... della prov. di Padova. Padua, 1842.
25. DE ANGELIS D'OSSAT, G. — La geologia agricola e le rocce della provincia di Roma. — *Boll. della Società degli Agricoltori Italiani*, Year V, No. 22. Rome, 1900.
26. DE ANGELIS D'OSSAT, G. — La geologia agricola e le rocce delle provincie di Roma e di Perugia. — *Bollettino del naturalista*, Year XXI. Siena, 1901-1902.
27. DE ANGELIS D'OSSAT, G. — La resistenza specifica elettrica delle rocce e dei terreni agrari. Ibid. — *Rendiconti della R. Accademia dei Lincei*, Vol. XII. Rome, 1903.
28. DE ANGELIS D'OSSAT, G. — I terreni acquitrinosi della Campagna Romana (Altipiano). — *Boll. Soc. Agricoltori Italiani*, No. 11. Rome, 1907.
29. DE ANGELIS D'OSSAT, G. — Il sottosuolo della Campagna Romana e le alberature. — *Boll. Soc. Agricoltori Italiani*, No. 16 ; *Rivista Agricola Romana*, Comizio Agrario di Roma. Rome, 1907.
30. DE ANGELIS D'OSSAT, G. — I terreni agrari di trasporto con particolare riferimento alla Campagna Romana. — *Rendiconti R. Accad. Lincei*. Rome, 1908.
31. DE ANGELIS D'OSSAT, G. — Azione coalinizzante delle radici sulle rocce laviche romane. — *Rend. R. Accad. Lincei*, Vol. XIX. Rome, 1910.
32. DE ANGELIS D'OSSAT, G. — Sul terreno leucitico irriguo. — *Rend. R. Accad. Lincei*, Vol. XIX. Rome, 1910.
33. DE ANGELIS D'OSSAT, G. — Parere sulle condizioni naturali della tenuta Fonte (Viterbo) agli effetti del vincolo forestale. — Printed by Cuggiani, Rome, 1911.
34. DE ANGELIS D'OSSAT, G. — Le rocce e le acque dell'Agro Romano rispetto alla calce. — *Rend. R. Accad. Lincei*, Vol. XX. Rome, 1911.
35. DE GASPERI and FERUGLIO. — I dintorni di Cividale del Friuli. — Studio geoagronomico. — *Bullettino dell'Associazione Agraria Friulana*, Year 1909, p. 152.
36. DE GIORGI, G.— Cenni di stratigrafia e idrografia provinciale considerate nei loro rapporti colla nostra agricoltura. — *Boll. Comiz. Agrario di Lecce*, II, No. 23. Lecce, 1871.
37. DE GIORGI, G. — Cenni di geografia fisica della provincia di Lecce. Lecce, 1884.
38. DE LORENZO, G.—Cenni Geolog'co-Agrari sulla Bas'l'cata. (in PARONA : Il Terreno).- *Nuova Enciclopedia Agraria Italiana*. Turin, Unione Tipografico-Editrice, 1908.
39. DEL PRATO, A.— La geologia ed il suolo coltivato nella provincia di Parma. - *Boll. Comizio Agr. parmense*, 1883.
40. FERRUA, N. — Sulla formazione del terreno vegetale. — Vigevano, Spazzella, 1873.
41. FERUGLIO, D. and G. — Contributo allo studio delle « Carte Agronomiche » in Friuli. - *Bullettino dell'Associazione Agraria Friulana*, Year 1907-1908, p. 105.
42. FERUGLIO, G. — Lo studio dei terreni Eocenici della Provincia di Udine. Il Bacino di Drenchia.—Prime note. - *Bullettino dell'Associazione Agraria Friulana*, Year 1901, p. 25.
43. GALVANI, D. — Marne rinvenute nelle escursioni geologiche delle provincie di Udine e Pesaro. - *Ann. Soc. agraria*, IX. Bologna, 1857.
44. GASTALDI, G. — Geologia e geognosia agraria. — *Enciclopedia agraria italiana*, II, 3. Turin, 1880.
45. GAVAZZI, P. — Analisi chimica della lava e delle altre sostanze eruttate dai vulcani, ecc. — *Ann. Soc. agraria*, X. Bologna, 1874.
46. GEMMELLARO, C. — Sopra le condizioni geologiche del tratto terrestre dell'Etna. — *Atti Acc. Gioenia*, I, 1. Catania, 1825.
47. GEMMELLARO, C. — Cenno sulla vegetazione di alcune piante a varie altezze del cono dell'Etna. — *Atti Acc. Gioenia*, I, 4. Catania, 1830.
48. GEMMELLARO, C. — Sulla causa geognostica della fertilità del suolo di Sicilia. — *Atti Acc. Gioenia*, I, 14. Catania, 1837.

49 GEMMELLARO, C. — Cenno geologico sul terreno della piana di Catania.— *Atti Acc. Gioenia*, I, 13. Catania, 1839.
50. GIORDANO, F. — Cenni sulla costituzione geologica della Campagna Romana. — *Boll. Com. geol.* Florence, 1871.
51. GIULI, G. — Statistica agraria della Val di Chiana. — Pisa, 1829.
52. GOLA, G. — Il terreno forestale. — *Giorn. di Geologia pratica*. Parma, 1912.
53. ISSEL, A. — Terreno e clima nelle provincie di Porto Maurizio e Genova. — *Atti della Giunta per l'Inchiesta Agraria*, Vol. 1883.
54. MANGANOTTI, A.— Sulla più conveniente ed utile coltivazione da applicarsi ai vari terreni delle provincie veronesi. — *Mem. Acc. di Verona*, 1848.
55. MARCHETTI, G. E. — Contributo alla conoscenza delle alluvioni del Guà. — *Giorn. Geol. pratica*. Catania, 1910.
56. MAZZINI, G. M.— La Toscana agricola. — *Atti della Giunta per l'Inchiesta Agraria*, Vol. III, 1881.
57. MINISTERO DI A. I. E C. — Catasto agrario del Regno d'Italia. — Rome, 1911-1912.
58. MINISTERO DI A. I. E C. — Ricerche e studi agro-geologici sulla Libia. La zona di Tripoli. Bergamo, 1912.
59. MINISTERO DELLE FINANZE. — Relazione della Sotto-Commissione incaricata di esaminare le tariffe di estimo della Provincia di Cuneo. Rome, 1911.
60. MIRAGLIA and GIORDANO. — Relazione sulla provincia di Massa-Carrara. — *Atti Inchiesta agraria*. Rome, 1883.
61. MUZI, L. — Terreni di Val di Cornia. — *Agricoltura italiana*, XXXII; pp. 6 and 37. Pisa, 1906.
62. NEGRI, A. — Montese, i suoi terreni geologici, ecc. — *Ann. Soc. nat.* Modena, 1881.
63. NICOLIS, E. — Carta geologica della provincia di Verona (in SORMANNI MORETTI - Monografia della Provincia di Verona). Verona, 1881.
64. NICOLIS, E. — Geologia applicata agli estimi del nuovo Catasto (Prov. di Verona) - *Atti dell'Accademia d'agr., scienze, lettere, arti e comm. di Verona*, Series IV, Vol. VII, Part I, Year 1906, p. 91. — Verona, 1907. (Preliminary summary) in *Giornale di Geologia pratica*, Year V, Part 1. Perugia, 1907.
65. NOBILI-VITELLESCHI, F. — Relazione sulle prov. Roma e Grosseto. - *Atti della Giunta, per l'inchiesta agraria*, Vol. XI, 1883.
66. ORZI, D.— I terreni agrari del territorio di Grotte di Castro. — Parte 1ª. Descrizione Geo-agronomica, 137 pp. with geo-agronomic map. — Perugia, *Giornale di Geologia Pratica*, 1906-1907.
67. PARETO, R. — Relazione sulle condizioni agrarie ed igieniche della Campagna di Roma. — *Annali del Ministero di Agricoltura*, 1872.
68. PANTANELLI, D. — I terreni quaternari e recenti dell'Emilia. — *Mem. R. Acc. Sc. di Modena*, Ser. II, Vol. IX, 1893.
69. PARONA, G. F. — Il terreno (Nozioni di geologia dinamica, storica e agraria). — *Nuova Enciclopedia Agraria*. Turin, 1898.
70. PASSERINI, N.— Analisi di terre coltivabili di galestro rosso delle colline di Moscino presso Scandicci. — *Staz. Sperim. Agrarie*, Vol. XXVIII, 1895.
71. PECILE, D. — Sulle carte agronomiche in Friuli. — *R. Stazione sperimentale agraria di Udine*, 1899.
72. PIRONA, C. A. — Costituzione geognostica e geologica del Distretto di Gemona. — Venice, 1859.
73. PONZI, G. — Del bacino di Roma e sua natura. — *Ann. Min. Agr. Ind. e Comm.* Rome, 1872.
74. PRINCIPI, P. — Osservazioni sui terreni agrari della Colonia Eritrea. — *Giorn. di Geol. Prat.* Year VIII. Perugia, 1910.
75. PRINCIPI, P. — Alcune osservazioni sul comportamento rispetto alla evaporazione dei principali costituenti minerali del terreno agrario. — *Giorn. di Geolog. pratica*. Parma, 1912.

76. PULLÈ, G.— Monografia agraria dell'isola d'Elba.— *Atti della Giunta per l'Inchiesta Agraria* Vol. III, 1881.
77. RAGAZZONI, C.— Saggio di terre vergini coltivabili della provincia bresciana.- Brescia, 1881.
78. REMONDINO, C — Le carte agronomiche e la loro importanza nella agricoltura razionale. — *Congresso Agrario internazionale,* I, 2. Rome, 1903.
79. RICCA-ROSELLINI, G. — I terreni d'Italia e le Carte Agronomiche. — *Boll. Min. di A. I. e C.*, IX, 1. Rome, 1910.
80. RICCIARDI, L.— Sopra i terreni derivanti dalle argille scagliose degli Appennini. — *L'Agricoltura Ital.*, XIII, 1887.
81. RICCIARDI, L. — Genesi e composizione chimica dei terreni vulcanici italiani. - *L'Agricoltura Ital.* — Vol. XIV-XV, 1888-89.
82. SACCO, F. — Il bacino terziario e quaternario del Piemonte. — Rome, 1889-90.
83. SANTAGATA, D. — Della geologia agraria e dell'origine della terra da lavoro. — Bologna, Sassi, 1845.
84. SAVI, P. — Studi geologico-agricoli sulla pianura Pisana. — *Atti dei Georgofili*, III. Florence, 1856.
85. SAVI, P. and CUPPARI, P.—Intorno al rimboscamento del M. Pisano. - Pisa, Tip. Nistri, 1886.
86. SESTINI, F.— Sopra l'analisi fisico-chim. delle terre coltivabili e la composizione chim. delle terre argillose dette biancane. - *Labor. chim. Univer. di Pisa*, 1879.
87. SQUINABOL, S. — Primo contributo allo studio geo-agronomico della Prov. di Padova. — *Atti Sindacato agricolo Padovano*, XII and XIII. 1901-1902.
88. STELLA, A.— Sullo sviluppo e indirizzo della geologia applicata in Italia. — *Bol. Soc. geol. it.*, XVI. 1879.
89. STELLA, A. — Contributo allo studio geognostico dei terren alluvionali nelle Valli Alpine. — *Bull. Com. geol. it.*, 1897.
90. STELLA, A. — Lo studio Geognostico-Agrario del suolo italiano e le carte agronomiche. — *Boll. della Soc. Geolog. Italiana*, Vol. XX (1901).
91. STELLA, A. — Il Montello. Descrizione Geognostico-Agraria. — *Memorie descrittive della carta Geologica d'Italia.* Rome, 1902.
92. TAMARO and CUZZONI. — Carta agronomica di Grumello del Monte. — Bergamo, 1898.
93. TARAMELLI, T.— Carta geologico-agraria del circondario di Capo d'Istria. — Udine, 1874.
94. TARAMELLI, T.— Cenni sul suolo e sul clima della Prov. di Treviso (in VIANELLO e CARPENÈ: La vite ed il vino nella prov. di Treviso). Treviso, 1874.
95. TARAMELLI, T. — Dei terreni morenici e alluvionali del Friuli. Udine, 1875.
96. TARAMELLI, T. — (and RICCA ROSELLINI, G.). Descrizione geognostica del Margraviato d'Istria. Milan, Vallardi, 1878.
97. TARAMELLI, T. — Condizioni geoagrologiche della prov. di Pavia (in P. SAGLIO: Monografia sulle condizioni agricole della prov. Pavia). Voghera, 1879.
98. TARAMELLI, T. — Descrizione orografica e geologica del bacino del fiume Crati, nella Calabria citeriore. Cosenza, 1880.
99. TARAMELLI, T.— Dello studio geognostico del suolo agrario, in rapporto col proposto censimento dei terreni produttivi del Regno. — *Boll. Soc. Geol. it.*, II, 2. Rome, 1883.
100. TARAMELLI, T. — Alcune osservazioni sui risultati di analisi meccaniche e chimiche del terreno coltivabile del Circondario di Pavia. — *Rend. Ist. Lomb.*, 1890.
101. TELLINI and NALLINO. — Carta geologico-agraria del podere del R. Istituto tecnico di Udine. Udine, 1900.
102. TELLINI, A. — Descrizione geologica della tavoletta Udine. — *Staz. sperim. agrarie.* Udine, 1900.
103. TOSO, P. — I terreni sabbiosi e la fillossera. — *Boll. Com. Geol. Ital.*, 1880.
104. TRABUCCO, G. — Carta agronomica della provincia di Piacenza. Florence, 1891.

105. TRABUCCO, G. — Carta geognostico-agronomica dell'Alto Monferrato (in Relazione sui mezzi più adatti a trasformare la viticoltura per la difesa contro la fillossera). - *Consorzio antifillosserico di Val d'Orba.* Florence, 1899.
106. TRABUCCO, G.—La geologia e l'agricoltura. Prolusione al corso libero di Geologia Agraria. Florence, M. Ricci, 1905.
107. TRABUCCO, G. — Le applicazioni della Geologia nell'Agricoltura moderna. — *Rassegna Nazionale.* Florence, 1904.
108. TRABUCCO, G. — Terreni agrari e carta agronomica della provincia di Firenze. Florence, 1907.
109. UGOLINI, U. — Nota botanico-geologica sui rapporti fra la vegetazione ed il suolo. — (*Commentari dell'Ateneo di Brescia*) 1912, p. 21.
110. UGOLINI, R. — I terreni di Rosignano e Castiglioncello (with 3 maps). Pisa, Nistri, 1910.
111. VAGLIASINDI, G. — Carte agronomiche e loro importanza. — *Agricoltura Italiana.* Pisa, 1908.
112. VINASSA DE REGNY, P. — Carte geologiche e carte agronomiche. — *Ann. Soc. agraria.* Bologna, 1900.
113. VINASSA DE REGNY, P. — Osservazioni sui terreni della Tripolitania settentrionale. — *Giornale di Geologia pratica,* I, 6. Genoa, 1903.
114. VINASSA DE REGNY, P. — Nozioni di Geologia agraria. Pisa, Spoerri.
115. VINASSA DE REGNY, P. — Geologia e agricoltura. — *Rivista agricola.* Piacenza, 1906.
116. VINASSA DE REGNY, P. — Il Terreno-Geologia agraria. Milan, Vallardi, 1907.
117. VINASSA DE REGNY, P. — Sul comportamento dei minerali nel terreno. — *Stazioni sperim. agrarie.* Modena, 1908.
118. VINASSA DE REGNY, P.—La seconda conferenza agrogeologica internazionale. — *Giornale di Geologia pratica.* Perugia, 1911.
119. VINASSA DE REGNY, P. — Terreni e culture della nuova terra d'Italia. — *Il Coltivatore,* 1912.
120. VINASSA DE REGNY, P. — I terreni della Cirenaica e la relazione della Ito. — *Giornale di Geologia pratica.* Parma, 1912.
121. VIOLA, V. — Sulle carte agronomiche. — *L'Eco dei campi e dei boschi,* IV. Rome, 1896.
122. VIOLA, C. —Le carte agronomiche e l'Istituto di Berlino. — *Soc. agricolt. it.,* VI. Rome, 1901.
123. VIOLA, C.— Sulle condizioni geologiche dei monti della Provincia romana in rapporto colla cultura agraria e silvana. - *L'Eco dei campi e dei Boschi,* IV. 1897.
124. VIOLA, C. — Lo studio geognostico-agrario del suolo italiano e le carte agronomiche. - *Boll. della Soc. Geol. Ital.,* Vol. XXI, 1901.

The Cultivation of Medicinal Plants in Hungary

by

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The climate and soil of Hungary offer very favourable conditions for the cultivation of medicinal plants, which has been practised from remote periods, without however attaining the social importance that it has at the present day. During the course of last century some dye plants played a very important part, as, for instance, madder (*Rubia tinctorum*), saffron (*Crocus sativus*), woad (*Isatis tinctoria*), dye-hollyhock, etc.; then

when chemical products took the place of these plants, this branch of farming lost its primitive importance and the cultivation of medicinal plants was also neglected.

In 1904 the writer proposed the more systematic utilization in Hungary of the abundant wild drug plants, the better cultivation of the most valuable among them, and the institution for this object of an Experiment Station. The same year the Ministry of Agriculture approved of this initiative and founded the Medicinal Plant Experiment Station at the Agricultural Academy at Kolozsvár (Klausenburg).

The Station studies the systematic cultivation of drug plants, determines their value, and studies all the questions concerning them. According to the results obtained, it promotes the cultivation of drug plants and assists beginners both in the cultivation of the plants and in disposing of them. Thanks to this service, every day the number of growers of such plants increases. Among the pioneers of the movement the curé Joseph Agnelli of Csári is especially worthy of mention as a grower and selector. Certain varieties produced by him, such as the *Agnelliana* varieties of *Mentha crispa* and *Mentha piperita*, are much esteemed, even abroad. On the other hand Dr. Eugene Szkicsák, chemist at Privigye, has organized the "Carpathia" Company for the cultivation and preparation of medicinal plants. Some large landowners are also beginning to turn their attention to the raising of certain drug plants, such as coriander, the product of which is sold abroad for the extraction of the essential oil. Lately also the growing of drug plants had been introduced into prisons, reformatories and deaf-and-dumb schools by the directors of such institutions, thus affording useful work to otherwise idle hands.

The Experiment Station has for the last eight years organized a yearly course for schoolmasters and the regional clergy, who in their turn spread among the people the knowledge they have acquired. Besides, the Ministry of Agriculture arranged courses in 1912 at Zsolna for the schoolmasters of Northern Hungary.

Among the numerous drug plants of Hungary the following are especially to be mentioned:

Curled mint (*Mentha crispa*).— Of late years the curled mint of Hungary has been in growing demand on the markets of the world, partly on account of its superior quality and partly owing to the increasing consumption of the essential oil of mint. Analyses made at the Experiment Station have demonstrated that the essential oil of Hungarian curled mint is characterized by its high laevocarvone content: 62 to 71 per cent., against 56 per cent. in the oil of American mint, 35 to 56 per cent. in the German oil, and 5 to 10 per cent. in the Russian product.

Hungarian curled mint is especially sought for by the large German firms, who export quantities of it to America. It is expected that this exportation will soon become very considerable. As for its yield, at least 11 cwt. per acre are obtained, and under favourable conditions 18 to 19 cwt. per acre of dry crop, which may be valued with the stalks at £1 1s 2*d* to £2 0s 4*d* per cwt. The gross yield may thus range from £12 to £40 per acre.

Peppermint (*Mentha piperita*) is cultivated in several regions of Hungary on greater extents of land. The dried leaves (*folia menthae piperitae*) are used for infusions, while menthol and the essential oil of peppermint (*oleum menthae piperitae*) are still more used. The value of this plant depends upon its menthol content. In this respect Hungarian peppermint is superior to American, for while the former contains 42.88 to 55.9 per cent. of free menthol and 55.38 to 65.19 per cent. of total menthol, the American peppermint contains 40 to 45 per cent. of the former and 59.6 per cent. of the latter.

Peppermint is cultivated in the Great Hungarian Plain (Alföld), as well as in the north of Hungary and in Transylvania. It is exported in great quantities to Austria and Germany; in 1912, however, the trade in this drug was not so brisk as in curled mint. Peppermint yields from 7 to 10 cwt of dry herb per acre worth about £1.14*s* to £2.2*s* per cwt., so that the gross returns from an acre range from £12 to £21.

Balm (*Melissa officinalis*) is grown in some dry localities of Hungary. At the Station the cultivation of this plant has succeeded admirably and the farmers of Upper Hungary and of the Alföld have obtained good results. On the whole it may be said that Hungary produces a fine and very aromatic balm, the climatic conditions of our country suiting it very well. It is not consumed to the same extent as the mints. According to experiments made at the Station, a revenue of about £23 per acre, after deduction of the cost of labour, may be expected from it.

Sage (*Salvia officinalis*) grows in similar conditions and is cultivated in gardens. It is a native of the South of Europe, where it grows wild and whence great quantities are sent to the markets of the world. Though it is exported from Italy and Dalmatia at a very moderate price, its cultivation is profitable, as the cultivated plant is more esteemed.

Clary (*Salvia Sclaria*) is also grown in Hungary. Its flowers and leaves are in great demand for their strong smell and aromatic flavour and are used especially for doctoring wines. Most of it goes to Germany.

Sweet marjoram (*Origanum Majorana*) is being increasingly grown in Hungary. It is sent to the Austrian, German and French markets. In Paris the celebrated marjoram of Provence has been compared with the Hungarian product and the latter has been found the finest and most aromatic. It has thus a great future before it in Hungary, especially on the right bank of the Danube and on the Alföld, where it is most cultivated. Marjoram can yield a profit of £12 per acre.

Hyssop (*Hyssopus officinalis*) and rue (*Ruta graveoleus*) thrive well in the dry parts of Hungary, especially on the Alföld, as they are very drought resistant. According to the experiments carried out at the Station, they can yield a yearly income of £11 5*s* to £22 10*s* per acre; nevertheless these two plants occupy a very subordinate position in the trade. Most of the exportation is to Austria and Germany.

Several large estates in Hungary grow coriander (*Coriandrum sativum*). Recently, Hungarian coriander has become an important factor in the trade, in which formerly Thuringian and Moravian corianders were predominant.

Sweet fennel (*Foeniculum officinale*). — In the trade Roumanian fennel is considered of superior quality and is much esteemed. It is immediately followed by the Transylvanian fennel. Its oil answers to the demands of foreign pharmacopœias.

Angelica (*Archangelia officinalis*) prefers districts with frequent rainfall; thus the experiments conducted at Kolozsvár gave very satisfactory results. It has also been cultivated in several districts of Upper Hungary.

Caraway (*Carum Carvi*) is cultivated in Hungary by small and large farmers, but it cannot compete with Dutch caraway. Anise (*Pimpinella Anisum*) is not yet cultivated in Hungary on a large scale, though its essential oil answers perfectly to foreign requirements.

Among the Hungarian medicinal plants which do not contain volatile oils, marsh mallow (*Althaea officinalis*) deserves to be mentioned first. It grows especially along the Tisza and in the fields along the large rivers, particularly on salt lands. Along the Tisza the wild plant is gathered by the people. There are, however, localities in which it is cultivated; the first year the roots are too small, so that only the leaves and flowers are gathered; in the second year it gives a crop of roots. In order to utilize the soil better, beets are planted between the rows of marsh mallows. This plant is in demand on the markets of the world; it is exported chiefly to Germany and to Austria, as either crude or prepared roots (cut into cubes).

Hollyhock (*Althaea rosea* var. *nigra*) is cultivated for its black flowers; it is used in medicine and as a dye-stuff. At present it does not enjoy the reputation that it formerly had; nevertheless it is still cultivated in some parts of Hungary.

Blessed thistle (*Cnicus benedictus*) is much esteemed in therapeutics under the name *herba cardui benedicti*. It is much used in the manufacture of the liqueur called Bénédictine. Its cultivation is very profitable; thus Hungary may hope to export great quantities of it in future. According to experiments made with this plant at the Station, it is capable of yielding a profit of £13 17*s* per acre.

Sweet flag (*Acorus Calamus*) grows in swampy places in Hungary. From its rhizomes and roots the drug known as *rhizoma calami* is prepared. In some localities it is planted in swampy grounds.

Marigold (*Calendula officinalis*) and mullein (*Verbascum phlomoides*) have been cultivated in Hungary for some years past for their flowers. The flowers of marigold (*flores calendulae*) are used for the adulteration of saffron and in the preparation of incense. In France marigolds are used on a great scale. The flowers of mullein (*flores verbasci*) are among the most precious and esteemed drugs. For this reason not only are the wild plants, which grow plentifully on the sandy soils of Hungary, gathered, but recently the plant has been cultivated. The cultivation of *Verbascum*, a biennial plant which flowers only in the second year, is to be recommended to small farmers who have large families in which the children could attend to the daily gathering of the flowers and to their careful drying.

Whilst most of these medicinal plants are grown in gardens, the cultivation in Hungary of the two varieties of mustard is carried out on

a large scale. The growing of white mustard (*Sinapis alba*) succeeds better than that of black mustard (*Brassica nigra*) and is consequently more practised in Hungary. Besides its use in medicine it is grown as green food.

I may mention also the following medicinal plants which are grown in Hungary on a small scale: *Chenopodium ambrosioides, Inula Helenium, Ocymum Basilicum, Artemisia Dracunculus, Artemisia Absinthium, Thymus vulgaris, Datura Stramonium, Atropa Belladonna, Anthemis nobilis, Conium maculatum, Levisticum officinale, Pyrethrum cinerariaefolium, Rheum, Tanacetum vulgare.*

The Profitableness of Present-day Sheep Keeping in Germany, especially in comparison with Cattle and Pig Keeping

by

Professor HOWARD, *Leipzig.*

The question of the profitableness of present-day sheep keeping has arisen without doubt from the unprecedented decrease in the flocks on the one hand and the increase in the numbers of head of cattle and especially of pigs on the other.

The live stock census in Germany shows the following returns:

Year	Numbers of Sheep	Numbers of Pigs	Numbers of Cattle
1873	24 999 406	7 124 088	15 776 702
(1907)	(7 703 710)	(22 146 532)	(20 630 544)
1912	5 787 848	21 885 073	20 158 738
	Decrease: 19 211 558.	Increase: 14 760 985.	Increase: 4 382 036.

N. B. — The data for 1912 are from provisional communications.

It must also be considered that these figures are the result of the grouping together of animals of various ages and without account being taken of their weight, and that in the census, which is always made in December, the calves, lambs and pigs born and slaughtered within the year are not included. In spite of this the figures are very eloquent as to the movement of the stocks within a period of close upon 40 years.

It appears at first sight that these changes are due to the recognition of the fact that sheep keeping is unprofitable compared with pig and milk-stock keeping.

In reality the question is not so simple. Sheep keeping has had to contend with hard times. The prices of wool have steadily and considerably fallen (though they have risen again from 1*s* per lb. in 1894 to 1*s* 6*d*

per *lb*. in 1911), and the possibility of selling fat sheep and lambs in France and England, which for a long time had played an important part, has been lost. The income from many flocks has thus considerably diminished, but the effect of these causes has been much overrated. Since 1894 the price of mutton has again risen, from about £2 9*s* 9*d* per cwt. carcase weight to £.3 15*s* 3*d*, and the prospects are that the prices will keep at this level or even rise, for with the increasing prosperity of the population the consumption of mutton, as can already be seen, increases. There are many other reasons for the decrease in the numbers of sheep in the country: the rapid disappearance of fallows and of commons, the increased cultivation of field crops, etc.

Unfortunately it must be said that the sweeping elimination of sheep, trough certainly sometimes the result of a careful consideration of all the circumstances, has in most cases been decided upon without that careful examination which in trade and in the industries is never neglected before abandoning some particular branch.

A clear vision of the profitableness of a branch of farming can only be obtained by careful figuring, and as this is difficult in farming, and many different opinions struggle for the mastery, one doctrine which evades all these difficulties has obtained wide diffusion; it asserts that farming is an organism from which no part can be separated or eliminated without injuring the whole; therefore each separate account is not only unnecessary but injurious and misleading.

Thanks to our marvellous progress in scientific knowledge and technical improvements, some unexpected increases of gross returns have been granted us. Connected with the endeavour to supply the people with food raised in the country itself, the increase of intensity in farming has become an axiom, unfortunately without due consideration of the limits of suitableness set for any given case.

It seems almost unnecessary to emphasize the fact that the increase of intensity is limited by the conditions obtaining, which cannot be overstepped without causing losses; yet it is just this consideration which it is so difficult to get people to recognize. The increased employment of capital and labour depends upon the will of the farmer, who shapes his course according to theoretical discussions and the results of experiments, but the effects hoped for may be limited or fail altogether owing to many adverse causes in the nature of the soil and the climate, or owing to the conditions of the markets.

How is it possible to judge these facts without the most complete control by means of accounts?

A mistake in the fields is punished once in the year with the unsuccessful crops, while mistakes in stock rearing, which owing to their smallness for each individual easily pass unnoticed, get multiplied by the number of head and by the 365 days of the year and can thus grow to such a magnitude that not rarely the most brilliant results of the field are completely swallowed up by the losses on the stock, and the farmer finds himself confronted with a negative total result.

It would be beyond the limits of this paper to enter into the question of the difficulties of agricultural accounts. They lie principally in the reciprocal relations between the fields and the stables. A theoretically perfect solution of these difficulties will perhaps never be found, but the practical way of evading them has long been pointed out; unfortunately it is discussed by many and followed by too few, because it is tedious, requires much care and causes expenses.

According to the above, it appears that it is impossible to answer the questions that have been raised, owing to the insufficiency of the material collected. I shall, however, endeavour to give a relatively practical solution, but I must first premise the following:

The most recent work of von Telschow on sheep breeding and rearing deals also with their profitableess and discusses it with the aid of an example of sheep keeping in which, according to his opinion, all the widely spread errors which he deplores and which are credited with being the cause of lack of success, have been avoided. But as in his account he has failed to consider on the one hand the hay, straw and pasture used and on the other the manure produced in the sheds, his work is only a calculation without any comtrolling and correcting connection with the rest of the farm. It is evident that precisely this want of control (all the more so that in this instance the capital invested in sheep is said to yield 22 ½ per cent. interest) is calculated to cause mistrust, dealing as it does with a branch of industry which is considered generally as unprofitable. The example misses in this manner the object for which it was intended.

Notwithstanding the difficulties attendant on the solution of the problem, I shall endeavour to answer the question which has been put, feeling justified in so doing for the following reasons: I have for the last 40 years, with the cooperation of the most eminent and intelligent farmers, striven to investigate with scientific rigour the profitableness of farming and, above all things, to ascertain the causes of the success or lack of success of the separate parts of the farm which go to make up the whole result. In this work I have found that the most progressive farmers have taken an ever increasing interest, and, in spite of the criticism of the majority of their colleagues who held opposite opinions, have in time recognised the error of too general theories, especially that which considers a farm as an indivisible organism (Organismus theorie).

In my research on the income of the several branches of a farm I have always sharply separated the questions concerning live-stock keeping from those dealing with the field crops, and each branch of farming has been most exhaustively examined, so that a clear idea can be had of each of them. This method enables me to treat separately any part of the work of farming.

Thus already 27 years ago I examined, with the help of my farming accounts and calculations, the conditions which were considered causes of the extraordinary decrease of sheep keeping, which had already set in. The result of this work proved, among other things, that the sale of wool and mutton had in reality nothing like as great an influence as was generally

attributed to them on the decrease in the numbers of sheep; it proved further that properly conducted sheep keeping was not only profitable, but could under suitable conditions surpass the profitableness of milch-cows and pigs.

The interest for these questions has in the meantime much increased, and two years ago I considered it opportune to attack again the prejudice against sheep keeping which had not yet been in any way shaken. I had the advantage of having much more available material, wich has been collected for the last 20 or 30 years always on the same principles, and has been proved to be correct by the other results of the farm.

I was thus able to establish that the general results of the earlier investigations are generally confirmed by the present ones and that undoubtedly for numerous farms keeping sheep is even now a branch of farming which deserves consideration and that under many conditions it yields more profit than cow or pig keeping, or at least as much. Nevertheless there are many farmers who, in spite of the instructive results of their book-keeping, have less faith in this than in universally accepted opinion, or who from a general point of view prefer unlimited increase of intensity of farming in the hope of realizing in the future extraordinary benefits.

The question now arises whether the results of these investigations, which, however carefully made, still represent only limited sources compared with the totality, are sufficient justification for conclusions baing drawn as to general conditions. I believe they are, as I am convinced of the correctness of the methods followed and of their results.

I shall give my results here in figures in the hope of supplying some useful data to farmers.

The following is a case of sheep breeding during a period of 15 years, from 1896-97 to 1910-11, which for want of space is divided into three periods of 5 years each. During the first period 350 sheep gave a loss per head per year of 4*s* 9*d* ; the next five years showed a profit of 1*s* 10*d*, and the last five a profit of 7*s* 7*d* per head per year, or an improvement of 12*s* 4*d*, making £ 224 5*s* per year for the whole flock.

In the above, interest on the capital in sheep is calculated at 4 per cent., that is 8 ¼ *d* per head. Thus a total of 8*s* 3*d* per head per year on a capital averaging 15*s* 8 *d* is equivalent to an interest of 53 per cent. (See Table on next page).

This is certainly the best result that I have found. I have, however, examined with the same care 45 farms, representing altogether 624 sheep-keeping seasons.

The total average shows a loss of 3*s* 10*d* per head per annum. The best result was a gain of 4*s*, the worst a loss of 12*s* 11*d*.

If rhe last five years are considered separately there is a slight improvement, as the loss is reduced to 3*s* 3*d*. It is satisfactory to note the individual good results, the best of which shows a profit of 8*s* 7*d*. Unfortunately for the reasons given above, and notwithstanding higher prices for wool and sheep, some farms have allowed their losses to grow, reaching as much as 15*s* 9*d* per head per annum.

DR: *Summary of the Sheep-keeping Accounts of Farm No. 7/1912. From 1896-1897 to 1910-1911.*

Year	Average number of head	Average value at beginning of year	General expenses consisting of: Management	Insurance	Rent of buildings	Rent of plant	Interest	Total	Expenses	Wages	Total expenses up to this point	Fodder	Litter (straw)	General total	Profit per head
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1896–97 to 1900–01. .	351.7	15 7.10	0 3.06	0 0.24	2 11.28	0 1.53	0 7.64	3 11.75	0 3.65	3 0.93	7 4.32	16 4.63	2 4.58	26 1.52	—
1901–02 to 1905–06. .	324.–	15 4.87	0 3.76	0 0.24	2 7.16	0 0.71	0 8.58	3 8.45	0 5.29	2 11.63	7 1.38	13 2.76	2 10.34	23 2.48	1 10.00
1906–07 to 1910–11. .	382 5	15 4.87	0 4.00	0 0.24	2 2.70	0 2.00	0 8.82	3 5.75	0 5.88	3 3.04	7 2.67	15 0.52	2 3.64	24 6.82	7 7.38

CR:

Year	Disposed of by sale, etc. — head	Sale price per head	Slaughtered — head	Died — head	Effectively sold — head	Wool and skins per head	Manure per head: in lbs.	Manure per head: in value	Average value at end of year	Loss per head	Wool — per lb.
		s. d.				s. d.		s. d.	s. d.	s. d.	d.
1896–97 to 1900–01. .	164	26 7.17	4	32	128	3 11.63	3 245	5 9.38	15 3.46	4 9.27	4 3/4
1901–02 to 1905–06. .	156	29 0.21	1	13	142	4 5.74	3 168	5 7.74	15 8.98	— —	5 1/2
1906–07 to 1910–11. .	212	36 2.06	1	10	201	5 7.03	3 694	6 6.91	15 0.28	— —	7

In the above calculations the interest on the capital (taken at 1*s* as an average figure) has always been added to the expenses.

A comparison with the profits of pig keeping leads to the result that this branch really yields relatively larger profits where the farmer has the ability to profit by the quicker turnover of his capital and of the brisk trade in young pigs, which, especially for small farmers, are so much easier to dispose of than lambs.

On the other hand, when the interest and the ability of the farmer are lacking, the losses on pigs are greater than those on sheep. The total losses on pigs, however, in comparison with those on other branches of farming, in spite of greater losses per head, are not sufficiently considered, as these animals are generally kept in smaller numbers and to a certain extent as a secondary industry, mostly for consumption in the household itself.

In the year 1912 I examined 36 farms keeping pigs, representing together 563 years of accounts, and found that the average results were a loss of 12*s* 4 ½*d* per head per year. Considering only the last 10 years, the average loss is reduced to 9*s*. A calculation of the interest was not advisable, on account of the constantly changing ages of the animals.

As for cow keeping, a comparison with sheep keeping is difficult, as the manner of keeping them varies so much more than with sheep, as the chief product (milk) and the way it is utilized cause the whole character of the farm to vary.

According to my investigations, cow keeping is liable to much greater losses, which in reality frequently occur. The examinations of accounts have led more easily and quickly to improvements, as in cow keeping the greater part of the returns are received daily, and a comparison with the expenses is so much easier to make.

I refer here, as a striking illustration, to the figures given in my book (*Landwirtschaftliche Buchführung* 1903, I, page 23) in which the cost of the production of milk is worked out from the accounts of 603 farms. The average cost price is 6.9*d* per gallon, while the net price realized is 5.2*d* per gal., the loss being consequently 1.7*d* per gallon.

As at present the conditions of the sale of milk have not materially improved, except in some centres, and the number of cows has not increased to any notable extent, as statistics show, I can without hesitation use the above data for the discussion of the profitableness of cow keeping. Premising that about 10 million cows yield an average of 1.1 gallon of milk per head per day, or 4015 million gallons per year, the loss of 1.7*d* per gallon represents a total loss to German agriculture of about £28 500 000 per annum.

BIBLIOGRAPHY.

Ergänzungsheft Nr. 1 zu den Vierteljahrsheften der Statistik des Deutschen Reiches 1909.
Vierteljahrshefte der Statistik des Deutschen Reiches 1912.
Arbeit zu XVI. Versammlung des Buchführungs-Interessenten-Vereins zu Leipzig 1912.
HOWARDS Vortrag im Zyklus für praktische Landwirte, Leipzig 1913 (Lecture by Prof. Howard in the series for practical farmers).

HOWARDS Vortrag im Merino-Züchter-Verein, Berlin 1913 (Lecture by Prof. Howard at the Society of Merino-Breeders).

TELSCHOW, U. *Grundriss der neuzeitlichen Schafzucht*. 1911.

WATERSTRADT, Prof. *Die Wirtschaftslehre des Landbaues*. 1912.

VON DER GOLTZ, Freiherr. *Handbuch der Landwirlschaftlichen Betriebslehre*. IV. Edit. 1912.

Illustrierte Landwirtschaftliche Zeitung, Year 1912, Nos. 49, 50, 55, 58; Year 1913, Nos. 33 and 43.

Deutsche Landwirtschaftliche Tierzuchit, Year 1910, No. 50; Year 1913, No. 9.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1 – **New Legislation on Fertilizers, Feeding Stuffs and Insecticides in The State of New Jersey.** – *Thirty-third Annual Report of the New Jersey State Agricultural Experiment Station and the Twenty-fifth Annual Report of the New Jersey Agricultural College Experiment Station for the Year Ending October* 31, 1912, *passim*. Union Hill, N. J., 1913. LEGISLATIVE AND ADMINISTRATIVE MEASURES.

In the United States, 41 out of the 52 States possess legislation on the trade in fertilizers and almost always also on feeding stuffs, insecticides and seeds. After Massachussets in 1872, New Jersey was the second State to pass a law on the inspection of fertilizers. (Cf. *The American Fertilizer Hand Book*, 1913, p. 92; and *Cyclopedia of American Agriculture*, Vol. IV, Legislation Relating to the Trade in Fertilizers, pp. 515-518). (1)

The old fertilizer law of 1874 served its purpose well in protecting the farmers of the State against fraud in the purchase of plant food. Not only has it been a means for preventing the adulteration and misbranding of commercial fertilizers, but it has also served an educational purpose in acquainting the users of these materials with the sources and agricultural value of the various forms of plant food. Meanwhile, however, as methods of manufacture were modified and new fertilizer materials were placed on the market, it became increasingly apparent that the old law fell short of fulfilling the purpose for which it was created. It thus became necessary to revise it, and this was accordingly done. The new law (Chap. 179, Laws of New Jersey, 1912) will enable the Experiment Station by means of its chemical adviser, called the State Chemist, to make a more thorough inspection of the fertilizers sold in the State. It will give more ample protection both

(1) For the new Swiss law on the same subject, see No. 1313, *B.* Dec. 1913.

to the farmer and to the legitimate manufacturer of fertilizers. Having been placed on a licence basis, the fertilizer inspection will permit the employment of a larger number of official samplers and inspectors. Any surplus of the licence fees remaining after the actual cost of inspection has been met, will be used for conducting experiments bearing on the use of fertilizers and the improvement of soils and farm methods in general.

The New Jersey feeding-stuffs law was enacted in 1900. Since then changes have occurred in the manufacture and composition of many brands. New products have also been placed on the market and new definitions have been created by control officials. By mutual agreement, control officials and manufacturers have adopted certain definitions and standards and a uniform feed law has been formulated. The new law constitutes Chapter 218, Laws of New Jersey, 1912. The inspection under this law is also entrusted to the State Chemist and has been likewise placed on licence basis. A more thorough inspection has been provided for, and more ample protection will be afforded to both purchasers and manufacturers of commercial feeding stuffs. The licence fees collected will be used to cover the cost of inspection, and any surplus remaining will be devoted to investigations of feeding stuffs and such other investigations and demonstrations as will serve to further the interests of agricultural practice.

The far-reaching changes introduced within the last five or six years in the manufacture and use of insecticides rendered necessary the revision of the insecticide law of 1906. The revised law constituting Chapter 89, Laws of New Jersey, is practically a copy of the Federal Insecticides Law. An appropriation of $ 1000 per annum has been made for carrying this law into effect. The amount appropriated is not sufficient for meeting the cost of the inspection. It is expected, however, that the general income of the Experiment Stations will be ample enough to meet any deficiency that may arise. Under the revised law, the fruit growers and market gardeners of New Jersey will be more certain to secure the protection and information so essential in the uninterrupted development of their important industry.

Great losses are suffered annually by the farmers of New Jersey on account of the poor seed purchased by them. The need of some guarantee that would help the purchaser to secure seeds relatively free from weed seeds and possessing a high germination coefficient was keenly felt by the farmers of New Jersey, and the director of the Experiment Station was instrumental in framing a measure that promises to afford the relief sought. The seed law as passed, constituting Chapter 157, Laws of New Jersey, 1912, will permit the Experiment Station to collect samples of seeds sold in the State, to test them for germination and purity and to publish annually the results of the seeds inspection. Residents in the State will have the privilege of having seeeds analysed for them without charge. It is expected that the publicity given in this manner to the seed trade will serve effectively to discourage the selling of inferior seed in the State. The enforcement of the law will be entrusted to a State Seed Analyst.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

2 – **Development of Farming in German South-West Africa.** — BERTHOLD, HANS in *Landwirtschaftliche Umschau*, Year 5, No. 46, pp. 1051-1053. Magdeburg, November 14, 1913.

Farming has of late years made relatively considerable progress in German South-West Africa; thus, in the district of Windhuk alone the area under cultivation rose from 230 acres in 1907 to 4606 acres in 1912. Still more important is the progress in live-stock breeding, as may be seen from the following table, which gives the numbers of head on April 1 of the years 1903, 1907 and 1912:

	1903	1907	1912
Cattle	90 385	52 189	171 784
African sheep	182 541	98 069	442 481
Wool sheep	4 201	3 526	46 901
African goats	156 727	99 563	448 279
Angora goats	3 391	3 696	20 431
Horses	5 265	3 119	13 340
Mules	88	4 216	4 879
Asses	899	1 630	7 015
Camels	3	487	789
Pigs	690	1 202	7 195
Persian sheep	—	—	12 588
Karakuls	—	—	4 094
Ostriches	—	—	1 277

The chief factors which determine the rapidity of the development of farming in new countries are the market conditions, the attention paid to the scientific basis of agriculture in the protectorate, and the conditions of credit. As for the market conditions, which are at present still very unfavourable, a suitable organization of the trade in and utilization of live stock, especially of the wool and ostrich feather trades, would be very beneficial. The protectorate should be provided with scientists (veterinary surgeons, bacteriologists, entomologists, foresters, botanists, chemists, experts in general agriculture and specialists for tobacco growing, animal husbandry, fruit growing and preserving), and the institution of experimental and model farms should be extended and perfected.

The writer anticipates notable advantages from the recent institution of an "Agricultural Bank for South-West Africa", with a capital of 10 million Marks (about £ 500 000) and the right to issue land mortgage bonds for ten times this amount. The object of the bank is to satisfy the three forms of credit: credit on the land, credit for improvements and personal credit, the latter by means of institutions such as cooperative associations already existing or to be founded.

3 – **Agriculture in the Belgian Congo.** — LEPLAE, E. in *Bulletin Agricole du Congo belge*, Vol. IV, No. 1, pp. 324, 153 figs., 3 plates. Brussels, March 1913.

This Bulletin consists entirely of the report presented to the Colonial Minister on agriculture in the Belgian Congo and gives a precise account of the agricultural conditions of the colony.

The writer considers in detail the important question of the colonisation of the equatorial part of the Congo; he enumerates the disadvantages under which agriculture labours and suggests the following reforms:

1) Easier conditions for the purchase and choice of agricultural land, particularly for plantations of less than 750 acres.

2) Ten years' exemption from taxes for agricultural buildings.

3) Suppression of import duties on materials required on plantations and of labour taxes.

4) Abolition of export duties on agricultural products and cheaper rates of transport.

5) A speedy organization of agricultural credit.

RURAL HYGIENE.

4 – **On the Hygienic Organisation of Workers in the Tropics.** — GERRARD, P. N., 80 pp. Singapore, 1913.

The writer lays special stress on the diseases most prevalent in the tropics, indicating means of avoiding and combating them. As an appendix the work contains plans of hygienic dwellings for natives.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY.

5 – **Agricultural Instruction for Soldiers.** — HANNE, R. in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXVIII, Part 47, pp. 636-642. Berlin, November 22, 1913.

The writer has attempted, by means of questions adressed to 220 teachers engaged in the agricultural instruction of soldiers, to arrive at some practical conclusions regarding the general success of the system which has been in operation in Germany for five years, and to gage the interest aroused in the students by the method of instruction, the time of instruction, excursions and inspections, and the use of demonstration material, etc.

6 – **The Agricultural and Veterinary College at Rio de Janeiro, Brazil** (1). — *Boletim do Ministerio da Agricultura, Industria e Commercio*, Year 2, No. 3, pp. 107-123. Rio de Janeiro, 1913.

On July 10, 1913, the Agricultural and Veterinary College at Rio Janeiro was opened, its foundation having been determined by the Decree of October 20, 1910, dealing with the organisation of agricultural instruction in Brazil. In its first term, the College was attended by 52 agricultural students, 8 veterinary students and 5 unattached students. An experiment and demonstration farm of about 470 acres is under the management of the College.

7 – **Agricultural Demonstration Train at Rosario de Santa Fé (Argentina).** — *Boletim do Ministerio da Agricultura, Industria e Commercio*, Year 2, No. 2, pp. 104-107 + 4 figs. Rio de Janeiro, 1913.

The writer describes the arrangement of the new agricultural demonstration train at Rosario, which has been running since the beginning of 1913 in the provinces of Santa Fé and Cordoba in the Argentine, and which consists of two railway cars, of which one is the lecture room (to accomodate 40 people) and the other is devoted to the scientific material for instruction on plant diseases.

(1) See No. 638, *B*, June 1913. (*Ed.*).

AGRICULTURAL INSTITUTIONS.

8 - **The "Société Nationale d'Agriculture de France".** — WERY, GEORGES in *La Vie agricole et rurale*, Year 2, No. 51, pp. 645-651. Paris, November 22, 1913.

The writer gives a short summary of the history of the National Agricultural Society of France from its establishment in 1760 by Bertin, De Turbilly and Bertier de Sauvigny, until the present day. He describes the condition of agriculture in France at the time of the foundation of this society, the circumstances of its establishment, the experiences of the society during the great social changes which have taken place in France, the activity of the Society in the publication of works dealing with scientific agriculture, and in the promotion of agricultural instruction and research. In conclusion a list is given of the eminent scientific and practical men whose names are most closely associated with the history and success of the Society.

AGRICULTURAL SHOWS AND CONGRESSES.

9 - **Agricultural Shows.**

Brazil.

1914. April (opening 21st). Minas Geraes. — Agricultural and live-stock show.

France.

1914. Feb. 26 - March 2, Cannes. — Flower show, organized by the "Société d'Horticulture et d'Agriculture de Cannes". Sec.: rue Châteaudun 19, Cannes.

Hungary.

1914. May-June. Budapest. — International wine and vine-growing show, organized by the Chamber of Commerce.

Russia.

1914. April. St. Petersburg. — International horticultural show.

Spain.

1915. Barcelona. — International exhibition of electric industries and applied electricity.

United Kingdom.

1914. March 18-19. Belfast, Balmoral. — Show and sale of Aberdeen Angus bulls, cows and calves, organized by the Royal Ulster Agricultural Society.

Uruguay.

On the initiative of the Ministry of Industry, the "Asociación Rural del Uruguay" (Montevideo) will organize two exhibition-fairs yearly, on the second Sunday in March and on Aug. 25 respectively. The first will include particularly live stock, crops, market-garden produce, flowers, poultry and connected industries and machines; the second forestry, fruit-growing, poultry, bees and connected industries and machines.

10 - **Agricultural Congresses.**

Belgium.

1914. April. Ghent. — Congress on the bettering of rural conditions, organized by the "Commission nationale pour l'embellissement de la vie rurale". General sec.: M. Verstraeten, 15 place van Artevelde, Ghent.

France.

1914. Feb. 17-19. Paris. — Annual congress of the "Société nationale d'encouragement à l'agriculture", held during the General Agricultural Show in Paris.

Hungary.

1914. May-June. Budapest. — National wine and vine-growing congress, held on the occasion of the International Wine-cellar Exhibition.

United Kingdom.

1915. May 22-29. London. — Fourth International Botanical Congress. General sec. of organization committee: Dr. A. B. Rendle, British Museum (Natural History), Cromwell Rd., London S W.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

11 - **The Selection of Land for Plantation in the Tropics.** — WOLTMANN in *Jahrbuch der Deutschen Landwirtschafts-Gesellschaft.* Vol. 28, Part 1, pp, 246-262. Berlin, May 1, 1913.

The writer has often had occasion to observe that the lack of success of plantations has been due to errors in the selection of the land.

When a farmer intends utilizing virgin soil for a plantation he should in the first place examine with attention the vegetation on it and the forms that it assumes ; as the vegetative conditions of a district depend chiefly upon the climate, it may be said that the susceptibility to cultivation of a soil is determined in the first place by *climatic conditions*, and of these the prevailing factors are *temperature* and *rainfall.*

Within the limits set by climate, the soil with its various properties becomes the decisive factor. In the first place there are the *ecological* factors in general and then the *geological* ones.

From the point of view of the latter the origin of the soil has to be investigated, that is from what rocks and by what process of decomposition it has been formed ; thus there are red soils, yellow soils and laterites widely spread in the tropics. Further the distinction between sedentary and transported soils must be noted. The study of the subsoil is also very important, especially from the point of view of moisture conditions.

For the *mechanical analysis* of tropical soils, the writer proposes the following form :

Tropics :
Sample of Soil No. from

I. A depth of 1 metre (3ft. 3 in) in four sections of about 10 inches each, if the soil is deep and uniform : each sample should weigh about 12 lbs.

If the soil is not homogeneous, or is in layers, or is superficial, the samples are to be taken from the various strata or formations in quantities of 9 to 13 lbs. as limits.

II. Rocks in course of weathering (about 4 ½ lbs.) } when present.
III. Unweathered rock („ „) }

The samples must be most carefully dried, catalogued and packed, and accompanied by the following data :

1. Plantation and situation.
2. Name of field.
3. Name of owner.
4. Geological formation.
5. Dip.
6. If the soil is under pasture, cultivation, steppe, plantation, etc., or virgin forests
7. Depth of arable soil.
8. Depth of loosened soil.
9. At what depth rubble is met with.
10. At what depth the rock is found.
11. Description of the section at every 4 inches in depth up to 1 metro (3ft. 3 in).
12. If water is present in the subsoil and at what depth.

13. Chief crop (coffee, cacao, cotton, tobacco, etc.).
14. Yield of the more important crops in normal years.
15. If manuring is practised, and if so, how often, and at what rate per acre with the various classes of manure.
16. Price or rent of the land.

For the mechanical analyses of the soil the writer finds Benningsen's method useful. It is to be noted that in the tropics humus has not the importance that it has in temperate regions, though very important for certain crops, such as cacao, vanilla, coffee and pepper. The mechanical analysis is also important for irrigation work in the tropics.

In *chemical analysis* the first step is the investigation of lime content, which is to be done on the spot, using hydrochloric and not acetic aid. Arid soils in the tropics are very rich in lime, while moist ones contain very little of this element. Now certain crops require lime: such are coffee, sugarcane, and among Leguminoseae especially earthnuts; other crops are more or less indifferent: thus maize and sorghum thrive in washed-out soils containing a minimum of lime.

In general, the writer believes that a tropical soil may be considered good and suitable for a plantation from the point of view of its capital in fertilizing substances, when it contains:

Soluble in cold hydrochloric acid:

lime + magnesia	0.2 to 0.5 per cent.
potash	0.1 » »
phosphorus pentoxide	0.1 » »
nitrogen	0.1 » »

The following form is proposed for the chemical analysis of tropical soils (see next page):

The determination of the *absorbent power* of the soil is important, especially in connexion with the prevalence in the tropics of red and yellow soils possessing a marked power of absorbing ammoniacal nitrogen and with the abundance of nitrogen in the rainfall of the tropics; thus a yearly rainfüll of 120 inches brings down about 72 lbs of nitrogen to the acre.

As for *bacteriological properties* the writer has observed the development of Leguminosae without nodules; nevertheless the practice of inoculation in spreading their cultivation may turn out favourable, especially for soy beans and earthnuts.

Turning to special crops, it may be said that *cacao* requires deep, warm and soft soils, rich in nutritive substances, especially potash, and not marshy. *Coffee* requires in the first place a soft soil, moderately moist and rich in plant food, so that it does not thrive on poor sandy soils or on lateritic ones. *Nutmegs* are very exacting as to soil, which must be of the best, and climate, which must have a uniform temperature from 69 to 90° F. and much rainfall. *Vanilla* demands humous soils, moist composts rich in plant food. *Sisal hemp* is suitable for those districts where the conditions of moisture are not of the best, being satisfied with 12 to 20 inches of yearly rainfall. *Cotton* grows on all kinds of soils excepting peaty or purely sandy ones;

Designation

Depth	0-25 cm. (10 inches)	25-50 cm. (10-20 in.)	50-75 cm. (20-30 in.)	75-100 cm. (30-40 in.)
Content in	per cent.	per cent.	per cent.	per cent.
Fine soil (under 2 mm.)				
Moisture				
Loss on ignition				
Nitrogen				
Absorbent power for ammonia				
Substances soluble in cold hydrochloric acid (450 gms. of fine soil for 48 hours with hydrochloric acid of S. G. 1.15)				
iron and alumina . . .				
of which iron				
» alumina . . .				
silica				
lime				
magnesia				
phosphorus pentoxide. .				
potash				
Substances soluble in boiling hydrochloric acid (50 gms. fine soil on water bath with 50 c. c. of hydrochloric acid S. G. 1.15)				
potash				
Class of soil (I to VIII) according to the content in fertilizing matter				
Remarks (nature of the soil, suitable crops, etc.)				

nevertheless, account has to be taken of the subsoil and of the climate, and varieties must be selected which can avail themselves of two or three months' rain. *Jute* wants moist alluvial soils. *Rubber* has no special requirements, save for the fineness of texture, which maintains that

moisture which seems to favour greatly the formation of latex. *Tan acacias* prefer the dry soils of arid regions. *Earthnuts* like deep and soft soils, never too moist, with sufficient lime and enough water for growth during the first few months. *Palms* behave differently according to their species: thus *coconuts* thrive on all soils except those containing stiff clay either on the surface or in the subsoil; the best are sandy coral soils and basaltic soils, even if rocky, provided they have not undergone weathering to clay; *date palms* must have abundant irrigation; *oil palms* grow on all soils, but prefer light sandy ones; *sago palms* prefer marshy lands. *Tuber and rhizome crops*, many species of which form the staple of the natives' food, thrive best on loose soft, deep, humous soils free from stones. *Bananas* do not like clayey soils, otherwise they grow everywhere, benefiting by organic manuring. *Maize* and *sorghum* have no special requirements, while *tobacco* prefers soft, warm, deep, humous soils rich in plant food and with sufficient potash.

As for the use of manures, the idea that tropical soils are inexhaustible is now exploded; on the contrary it may be said that they get exhausted easily (1). In such cases they are manured or left fallow, or they are abandoned for new lands. Which of these methods is to be preferred depends upon the economic conditions, especially the cost of manuring. It is to be considered that manuring has the effect of not only increasing the crops but also ensuring them; and if sometimes, as for instances with tobacco (Havana), it may injure the quality of the crop, it may be said that in general it keeps the plants healthier. But perhaps the most important effect of manuring is that of prolonging the duration of plantations; thus, for instance, whilst cocount palms live usually about 70 years, the use of manure prolongs their productive existence to 80 and 100 years; for coffee, also, a suitable and early manuring may prolong the life of the plantation by 5 or 10 years.

It is to be expected that systematic experimentation, such as the German Colonial Office and the Colonial Section of the German Agricultural Society have already undertaken in the German Colonies, will give the same results as it has given in Germany (2). Greater care is, however, necessary in the choice of the manures; thus in the moist tropical regions and especially on ferruginous soils, a deficiency of phosphoric acid is hardly to be feared; potash salts mostly give good results in the regions of abundant rains, whilst potash abounds in the arid belts; in general nitrogenous manures are not to be recommended in the tropics as they are in the temperate zones; lastly when liming is required it must be done under the form of marl or ground limestone, quicklime being rather too energetic in tropical soils. In a general way it may be said that the colonial farmer must pre-

(1) See No. 1278, *B.* Sept. 1913. (*Ed.*).

(2) See No. 480, *B.* May 1913, and BUSSE, W. (Director of the Imperial German Colonial Bureau). The Organization of Experimental Work in the German Colonies. — *Bulletin of the Imperial Institute*, Vol. XI, No. 3, pp. 462-468. London, July-September 1913 (*Ed.*).

fer the less easily soluble manures to the more soluble ones, especially in those regions having a high rainfall which easily leaches the soil: thus sulphate of ammonia and Peruvian guano are to be preferred to nitrate of soda; and bone meal to superphosphate, the soluble phosphoric acid of which rapidly retrogrades in red and yellow soils.

12 - **The Soil Solution and the Mineral Constituents of the Soil.** — HALL, A. D., BRENCHLEY, W. E., and UNDERWOOD, L. M. (Rothamsted Experiment Station) in *Philosophical Transactions of the Royal Society of England*, Series B, Vol. 204, pp. 179-200. London, October 21, 1913.

The following investigations were undertaken to examine: 1) the effect of fertilizers on the concentration of the soil solution; 2) the effect of solutions of different concentrations on the growth of the plant; 3) the effect of distributing the food solution over solid particles (such as sand, silt, clay) on its availability to plants growing in such media.

The first question was attacked by treating soil from certain plots of known history with tap water and using the liquid thus obtained for water cultures. The moist soil as it came from the field was mixed with tap water in the proportion of 20 kg. of dry soil to 25 litres of water. After thorough mixing, the soil was allowed to settle, and the supernatant liquid was siphoned off, filtered, and run into 600 c. c. bottles, into which seedlings were set. The contents of the bottles were renewed at fortnightly intervals. Each unit of comparison consisted of 10 plants, and to further minimise disturbing factors, the experiments were carried out in early spring when the most satisfactory growth is obtained.

The soils were drawn from both the permanent wheat and the permanent barley fields, and plots were selected having received the following treatment:

1). Unmanured, or U.
2). Received nitrogen only annually, or N.
3). » nitrogen and phosphoric acid annually, or N. P.
4). » nitrogen and potash annually, or N. P.
5). » complete artificial fertilizer annually, or N. K. P.
6). » dung annually, or D.

As the problem under investigation was not concerned with the nitrogen supply, this factor was eliminated by adding sodium nitrate to all solutions at the rate of 0.25 gm. per litre. Both wheat and barley (pure lines) were grown in each solution for a period of 8 weeks, after which the plants were removed, dried and weighed.

The mean results are set out in Table I.

The growth in the solutions from the various soils shows differences which are parallel to those obtained in the crops on the same plots. Further, the growth in the solutions is such as would be anticipated from the composition of the solutions, large quantities of which were evaporated and analysed with the results set out in Table II (p. 48), where the analyses of the soils used and the amounts of the fertilising elements applied in the manure are also given.

TABLE I. — *Mean dry weight of plant in gms.*

Soil	Wheat			Barley		
	Shoot	Root	Total	Shoot	Root	Total
Wheat field, Plot *U.*	0.170	0.135	0.305	0.212	0.105	0.317
» » *N.*	0.157	0.127	0.284	0.171	0.101	0.272
» » *N. P.*	0.598	0.260	0.858	0.660	0.175	0.835
» » *N. K. P.*	0.923	0.448	1.371	1.302	0.442	1.744
» » *D.*	1.137	0.425	1.562	1.249	0.377	1.626
Barley field, Plot *U.*	0.240	0.169	0.409	0.264	0.138	0.402
» » *N. P.*	0.476	0.199	0.675	0.611	0.137	0.747
» » *N. K.*	0.208	0.201	0.409	0.275	0.119	0.394
» » *N. K. P.*	1.203	0.627	1.830	1.600	0.477	2.077
» » *D.*	1.195	0.511	1.706	1.364	0.486	1.850

It will be seen that the composition of the soil solution reflects the manurial history of the plots, and corresponds to that of the soil as judged by either the "total" or the "available" plant food it contains.

The following year (1912) the experiments were resumed, and, as the results given by the wheat and barley soils had been so similar, they are on this occasion confined to solutions made from the barley soils only. In order to examine further the conclusion that no other factor entered into the effects produced by the soil solutions than the amount of plant food they contained, comparisons were made between: 1) a culture solution made up in the laboratory to the same concentration in essential nutrients as the solutions from the completely manured soils (4.7 parts per million P_2O_5 and 26.7 parts per million K_2O); 2) the soil solutions; 3) the soil solutions from the partially manured plots, with their essential deficiencies repaired by the addition of phosphoric acid or potash or both; 4) a further artificial solution was made up to a much higher concentration, to one in common use in the laboratory; lastly, 5), the salts in this artificial solution (303.5 parts per million P_2O_5 and 312.4 parts per million K_2O) were added to the soil solutions. As before, in all cases sodium nitrate was added at the rate of 0.25 gm. per litre or 41 parts of nitrogen per million. Barley plants were grown for 7 weeks with the results set out in Table III.

From these results, the following conclusions may be drawn. The artificial culture solution of low concentration yielded plants whose weight (0.763) was distinctly lower, but of the same order as these grown in the soil solutions from the completely manured plots (0.963 and 1.465). The artifi-

TABLE II.

Field and Plot	Phosphoric Acid				Potash			
	In soil solution	In soil: Total	In soil: Citric acid soluble	Manure annual supply	In soil solution	In soil: Total	In soil: Citric acid soluble	Manure annual supply
	parts per million	per cent	per cent	lbs. per acre	parts per million	per cent	per cent	lbs. per acre
Wheat, Plot *U*	0.656	0.114	0.0078	0	3.64	0.220	0.0032	0
" " *N*	0.881	0.123	0.0074	0	3.55	0.240	0.0032	0
" " *N.P*	3.839	0.197	0.0405	60	3.88	0.197	0.0032	0
" " *N.K.P.*	3.938	0.195	0.0547	60	26.22	0.262	0.0232	100
" " *D.*	4.838	0.215	0.0560	46	29.85	0.285	0.0384	60
Barley, Plot *U*	0.525	0.099	0.0055	0	3.40	0.183	0.0036	0
" " *N.P*	3.900	0.173	0.0425	60	3.88	0.248	0.0023	0
" " *N.K*	0.808	0.102	0.0081	0	30.33	0.257	0.0407	100
" " *N.K.P.*	4.025	0.182	0.0500	60	24.03	0.326	0.0298	100
" " *D.*	4.463	0.176	0.0447	46	26.45	0.167	0.0321	60

cial culture solution of high concentration yielded heavier plants (0.943), approaching those obtained from the completely manured soils, though still below the maximum. The soil solutions from the unmanured plot and the imperfectly manured plot (N. P.) yielded plants of a much lower order of magnitude (0.216 and 0.486). The addition of the missing nutrients to the solutions from the imperfectly manured soils produced growth approaching the maximum (1.214 and 1.154); when the nutrients were added to set up the higher concentration, the growth produced was equal to that obtained from the artificial culture solution of the same concentration (0.974 and 0.925 against 0.943) though still below the maximum.

These results confirm the conclusion drawn from the previous set of experiments: that the growth of plants in the soil solutions is in the main determined by the amount of plant food the latter contain. One other point was suggested by the results: that the soil solutions, particularly those from the dunged plot, were better media for growth than the artificial culture solutions of equivalent concentiation, possibly owing the the presence of soluble nitrogen compounds especially valuable to the plant in the earlier stages of growth. On the other hand, it is unsafe to lay much stress on such differences in weight as are exhibited in the growth of the plant in the solutions regarded as complete (0.943, 1.214, 0.974, 1.154, 0.925, 0.963, 1.349 1.465, 1.286).

TABLE III.

Nature of solution	Dry weight in grms.		
	Shoot	Root	Total
Artificial culture solution, low concentration	0.514	0.249	0.763
» » » high »	0.652	0.291	0.943
Soil solution, Plot *U*	0.116	0.100	0.214
» » » + added salts, low concentration . . .	0.865	0.349	1.214
» » » » » » high » . . .	0.677	0.297	0.974
» » Plot *N. P.*	0.353	0.133	0.486
» » » + added salts, low concentration .	0.795	0.359	1.154
» » » » » high » .	0.619	0.306	0.925
» Plot *N. K. P.*	0.685	0.278	0.963
» » » » + added salts high concetration	0.926	0.423	1.349
» » » » Plot *D.*	1.069	0.396	1.465
» » » » + added salts high concentration	0.814	0.472	1.286

These conclusions were checked by two further sets of experiments, where first barley and then peas were grown in the artificial culture solution of low concentration; in soil solutions with their phosphoric acid and potash made up to standard by the addition of mineral salts; in soil solutions made up above standard strength; and lastly a set was included from which the sodium nitrate was left out. The results of these series were in complete accord with those of the preceding series. The addition of nitrogen alone to the soil solutions produced no increase in the plant, indicating that the soils themselves had yielded more than enough nitrate for the needs of the plant, the growth of which had been limited by the amount of phosphoric acid and potash present in the solution. The evidence for the presence in the soil solutions, even in those from the dunged plots, of other substances favourable to growth was slight.

Analyses of drainage waters from the wheat plots during the progress of these experiments showed that, though always more dilute, the drainage waters followed the same sequence as the soil solutions with regard to their content of phosphoric acid and potash.

The results of these experiments also bear on the question of plant toxins left behind by one crop and having a depressing effect on succeeding crops of the same kind. The wheat and barley in Table I yielded almost exactly the same weight of plant in the solutions from the wheat soils and in the solutions from the barley soils, the latter yielding slightly heavier plants with both cereals. Again, wheat and barley grown in the same solution yield weights agreeing within the range of error of such experiments. These facts alone would indicate the absence in the soil of any soluble toxin injurious to either plant; but the investigation was pushed a step further by comparing the growth in an artificial culture solution, in a set of soil solutions boiled before use, and in another set where the solutions were evaporated, the residues ignited, and then dissolved afresh. The boiling was without effect and igniting the residues generally had a depressing effect on growth. The results were confirmed by similar experiments with lupins, sunflowers and buckwheat and with the peas mentioned above; the growth of the other plants corresponded with that of the wheat or barley.

The relation between the growth of the plant and the concentration of the nutritive solution, as distinct from the total amount of the nutrients supplied, was also investigated independently of the soil solutions. A standard culture solution was made up containing 0.5 gm. each of potassium di-hydrogen phosphate, magnesium and calcium sulphates, and sodium chloride, 1.0 gm. of potassium nitrate, and 0.04 gm. of ferric chloride, equivalent to N 138, P_2O_5 261, and K_2O 743 parts per million. Barley was grown in bottles containing 600 c.c. of the above solution, at full strength, and diluted to $^1/_5$, $^1/_{10}$ and $^1/_{20}$ respectively, the trials being made in duplicate only. Growth proceeded for 8 weeks with the results set out in Table IV.

From the very outset the growth in the various solutions proceeded in the order of their concentrations, so that the final weights may be taken to represent the rates of growth throughout and not an ultimate condition brought about by the exhaustion of the food supply, though the more dilute solutions were at the finish depleted of the nitrogen they originally contained. To obviate the effects of this depletion a second set of experiments was carried out, in which the solutions were renewed weekly, the other conditions remaining as before. Confirmatory results were obtained. Then a new series was arranged in which the plants were grown in coarse sand contained in vertical glass cylinders through which the nutritive solution slowly percolated. The cylinders contained 800 gms. of coarse sand mixed with 4.25 gms. of calcium hydrogen phosphate (the potassium phosphate was withdrawn from the nutritive solution), and 100 c.c. of the nutritive solution daily was allowed to drip very slowly on the sand, percolate through it, and escape. Growth was continued for two months, with the results set out in Table V.

The solutions escaping from the sand were regularly tested and found to contain nitrate, except in the last weeks of growth with the more dilute solutions.

TABLE IV.

Concentration of solution	Dry weight in gms.		
	Shoot	Root	Total
1	1.323	0.332	1.655
	1.605	0.470	2.075
1/5	0.977	0.268	1.245
	1.087	0.405	1.492
1/10	0.742	0.288	1.030
	0.690	0.253	0.943
1/20	0.462	0.219	0.681
	0.369	0.168	0.537

TABLE V.

Concentration of solution	Dry weight in gms.		
	Shoot	Root	Total
1	2.969	0.769	3.738
	2.393	0.787	3.180
1/5	1.218	0.304	1.522
	1.698	0.555	2.253
1/10	1.148	0.690	1.838
	0.837	0.221	1.058
1/20	0.488	0.280	0.768
	0.603	0.308	1.011

Two more sets of experiments were carried out in which barley and lupins were employed as test plants and 500 c. c. of solution was dropped though daily. As it was late in the season for satisfactory work, the results were a little erratic, but there could be no doubt of the superiority of plants growing in solutions of higher concentration.

The whole series of experiments confirms the conclusion previously reached that the concentration of the nutritive solution within certain wide limits, irrespective of the total amount of plant food available, is a factor in the rate of plant growth which varies directly, though not proportionally, with the strength of the solution in the particular nutrient or nutrients limiting the growth.

To investigate the third question mentioned above (*viz.* the effect of distributing the food solution over solid particles on its availability to plants), plants were grown simultaneously in water cultures and in sand cultures where 600 c.c. of the food solution was mixed with 3 kg. of fine silver sand (above 0.2 mm. in diam.), these being the proportions required to work the sand up into a fine "crumb" structure. Barley was the trial plant, and the same solutions varying in concentration from 1 to $\frac{1}{20}$ were employed. Every two or three days the jars containing the sand were weighed, and the original water content restored by the addition of pure water. Table VI shows the results obtained.

TABLE VI.

Concentration of solution	Dry weight of plant in gms.	
	Water	Sand
1	1.655	7.050
	2.075	4.200
$\frac{1}{5}$	1.245	3.539
	1.492	3.031
$\frac{1}{10}$	1.030	3.171
	0.943	2.882
$\frac{1}{20}$	0.681	1.556
	0.537	1.437

Far from there being any retardation of growth in the sand due to slowness of diffusion of the nutrients in the water films, the sand cultures

were markedly superior to the water cultures, though as before the rate of growth varies with the concentration of the nutrients in the solution. Confirmatory results were obtained when the experiment was repeated and the nutrients (in a concentrated form) were placed inside narrow cylinders of porous earthenware themselves filled with sand and packed in the sand in which the plant was growing. In this case the roots never came into contact with the nutrient solution until it had diffused through the porous cell into the mass of sand beyond.

To extend these experiments to solid media made up of finer particles than the silver sand, a large quantity of a sandy soil was graded into "coarse sand" as before, "fine sand" (0.2-0.04 mm.) and "silt" (0.04 — 0.01 mm.), while pure kaolin was taken to represent a clay material. The same solution was diffused through all the materials. Barley, and later lupins, were grown in each medium with the following results (Table VII).

TABLE VII.

Nature of medium	Dry weight in gms.					
	Barley			Lupins		
	1.	2.	Mean	1.	2.	Mean
Water	1.350	1.190	1.270	0.822	1.162	0.942
Coarse sand	1.456	1.369	1.412	2.486	2.462	2.474
Fine sand	0.581	0.624	0.602	0.896	1.367	1.131
Silt	0.800	0.472	0.636	1.416	1.371	1.393
Kaolin	1.026	0.719	0.872	1.742	1.925	1.833

Through an accident the barley in the water cultures received twice the volume of the solution diffused through the solid media, but even here the coarse sand preserved its superiority. With the lupins, growth in each of the solid media proved superior to that in the water culture, so that the possibility of retardation of growth due to slowness of difusion may be dismissed. To explain the superiority of the cultures in sand over the water cultures, and again the superiority of the cultures in coarse sand and kaolin over those in fine sand and silt, the writers were led to suspect, by the appearance of the roots, differences in the aeration of the root as a disturbing factor. Both the coarse sand and the kaolin remained in an open state, while the fine sand and the silt settled down to a compact mass. To test this hypothesis, the effect of continuous aeration was tried on water cultures, in the case of both barley and lupins; an increase of 60 to 80 per cent. was obtained by the aeration. Finally, another set of experiments was carried out in which the water was added to the solid media from below,

so as to obviate as much as possible the settlement of the silt. Settlement still occurred, but the growth was made more nearly equal, though the results are not conclusive as to whether aeration is the only factor concerned, and whether the fines particles in the kaolin and silt are not holding back some of the nutrients from the plants by "adsorption".

The net result of the whole investigation is to restore the earlier theory of the direct nutrition of the plant by fertilizers. The composition of the soil solution, which determines the growth of the plant, is dependent upon the amount and the mode of combination of the phosphoric acid and potash in the soil, both of which are affected by the fertilizer supply, though to what extent is not yet determinable.

13 - **The Influence of Salts Common in Alkali Soils upon the Growth of the Rice Plant.** — MIYAKE, K. (College of Agriculture, Tohoku University, Japan) in *The Journal of Biological Chemistry*, Vol. XVI, No. 2, pp. 235-263. Baltimore, November, 1913.

Rice plants were grown in water cultures of varying concentrations of salts of sodium, potassium, magnesium and calcium, separately and in combination.

The growth of the plants under the different conditions was noted and the following results obtained:

A. — Single salts of the above metals.

1) The salts act as stimulating or toxic agents according to the concentration.

2) The toxic concentrations of magnesium sulphate and chloride, calcium chloride and sodium chloride and carbonate are greater than $\frac{N}{100}$, while those of sodium sulphate and bicarbonate are greater than $\frac{N}{50}$.

3) The concentrations of greatest stimulation were for magnesium sulphate $\frac{N}{500}$ for magnesium chloride and calcium chloride $\frac{N}{1000}$ to $\frac{N}{5000}$, for sodium chloride $\frac{N}{50}$ to $\frac{N}{100}$, for sodium carbonate and bicarbonate $\frac{N}{100}$ to $\frac{N}{500}$.

B. — Two salts in combination.

4) Different cations are mutually antagonistic; the same effect occurs between different anions, but in a less degree. Thus the limit of concentration producing toxic effects is higher in mixtures of salts.

5) The curve for concentration and antagonism between sodium and potassium salts shows two maxima.

6) The antagonism between potassium and magnesium or calcium is almost complete, so that at certain proportions the toxic effect completely disappears.

7) The antagonistic action of calcium cannot be replaced by barium or strontium.

These results have considerable bearing on soil fertility, especially in alkaline soils.

14 - **Culture Experiments on Sick Soils.** — PERITURIN, TH. T. in *Isviestia Moskovskago Selskokhosiaistvennago Instituta*, Year XIX, Part. 4, pp. 1-137 (138-141), figs. 35. Moscow, 1913 (1).

The writer mentions the opinions of those American workers who hold that soil sickness is due to the presence in the soil of substances injurious to plants, which are produced by excretion from the plants themselves or, as has lately been believed, by independent formation in the soil. He then recalls Istsherekov's experiments, according to which a repeated lixiviation of a sick soil seems to have had a favourable effect on plant development, this effect being attributed to the removal of the injurious substances.

Lastly, according to experiments carried out by the writer, who made three successive cultures of oats in distilled water, this injurious action was not observed (2).

It was different in a series of sand-culture experiments. In glass vessels filled with pure quartz sand and treated with Hellriegels nutritive solution, several kinds of plants were grown in succession (up to three following one another) for a six weeks' period. In almost all the experiments the plants of the second sowing seemed to be sickly; the weight of 10 plants when they were gathered, referred to the first crop taken as 100, is given in the accompanying table.

The unfavourable effect on the second crop in the majority of cases is evident. On adding to the pots 15 grams of pure powdered charcoal after the first crop, the unfavourable effects cease and the plants of the second cultivation develop as well as those of the first. The results may be summarized as follows:

1. — Through repeated cultures in the same pots the plants assume abnormal characters owing to which the yield of the second sowing is considerably diminished.

2. — The root residues of the first crop, on decomposing, cause in some way the diminution of the yield of the second crop.

3. — The abnormal development of the second culture cannot be attributed wholly to the alkalinity of Hellriegel's solution after the first culture.

4. — The abnormal development of the second culture is observed both when the same plant is cultivated in immediate succession or after alternating with plants of other botanical groups.

5. — The addition of charcoal prevents the unfavourable effects on the second culture.

In another series of experiments, cultures were made in glass vessels filled with earth from various localities in Russia. Oats and wheat were

(1) Our article is substantially a translation of the author's summary in German. (*Ed.*).

(2) Some recent experiments, of a preliminary character, seem to confirm in the case of peas in water-cultures the excretion from the roots of substances poisonous for the same plant, both in distilled water and in river water. (MOLLIARD, M. Sur la sécrétion par les racines de substances toxiques pour la plante. — *Bulletin de la Société Botanique de France*, Year LX, Part. 5, pp. 442-446. 1913). (*Ed.*).

Plants first sown	Yield of first sowing	Yield of subsequent sowings										Average of subsequent sowings
		Oats	Maize	Millet	Flax	Buckwheat	Camelina	Hemp	Beets	Peas	Poppy	
Oats	100	84.7	—	52.5	—	130.0	—	107.9	138.4	91.4	—	—
Maize	100	—	68.5	—	—	—	—	—	—	—	94.3	81.4
Millet	100	—	—	21.1	—	—	—	—	—	—	39.1	30.1
Flax.	100	—	38.4	—	44.0	—	31.6	—	51.8	89.3	—	51.0
Buckwheat	100	98.1	—	—	—	81.2	—	125.6	—	—	82.8	87.4
Camelina	100	—	—	—	44.9	—	17.8	—	—	—	—	29.9
Hemp	100	—	—	—	—	—	—	103.7	—	—	—	103.7
Beets	100	—	86.9	—	—	—	—	—	93.2	—	—	90.0
Peas	100	—	—	79.2	—	99.0	87.8	—	—	80.4	—	86.6
Poppy	100	—	—	—	—	—	—	—	—	—	—	—

sown and gathered after six weeks; the ground was then turned over and the superficial part was sifted, after which it was again sown. This second sowing developed badly, yielding a lighter crop. The application of complete manuring made practically no change in these abnormal results. Summarizing:

1. — In making two successive cultures in the same pot it was observed that the second yielded a markedly inferior crop and showed abnormal development.

2. — The application of complete manuring had an insignificant action on this abnormality.

3. — The abnormal development of the second culture is evidently to be attributed to injurious substances which have been formed during the first culture, as the alkalinity observed in the soil cannot be the only cause.

In a last series of experiments the writer cultivated three plants of oats or buckwheat suspended on nets in glass vessels of the capacity of 2 litres. The vessels were filled with a solution or watery extract of soil obtained by lixiviativg 3 kg. (6.6 lbs.) of dry earth with 3 litres of water; in one set of pots the solution was boiled, in another it was filtered through charcoal, and in a third it was used as it was; to every pot Hellriegel's mixture was added. The solution of most of the soils showed toxic properties causing abnormal development and a sickly appearance. The plants developed quite normally in the pots containing the solutions filtered through charcoal; they behaved variously in those containing the boiled solution, developing sometimes normally, at other times abnormally. In the solutions of soil which had not been previously sown to cereals, the development was normal.

Summarizing:

1. — The solutions of sick soils contain substances injurious to plants which may be eliminated by filtering through charcoal.

2. — Boiling only eliminates these injurious substances from some soils.

3. — The solutions of soils not previously sown to cereals do not contain injurious substances.

4. — It does not appear that the soil solutions exert a noxious action for only one plant, but on vegetative development in general; it is no question of specific or toxic action upon certain species or genera.

15 - **Enrichment of Farmyard Manure by Cake Feeding.** - HALL, A. D. in *The Journal of the Board of Agriculture*, Vol. XX, No. 8, pp. 665-672. London, Nov. 1913. MANURES AND MANURING.

Whilst a Hertfordshire land similar to that on which the Rothamsted experiments are conducted yielded formerly a crop of about 20 bushels of wheat per acre under the old four-course rotation, the introduction of new sources of fertility during the last seventy years has raised the production to something over 30 bushels per acre. This extra fertility is usually obtained by the English farmer from two sources: 1) artificial manures, like guano and nitrate of soda; or 2) imported feeding stuffs, like linseed, cotton cake and maize.

Which source is the cheaper is not a question capable of any general answer, but the English farmer has usually preferred the feeding stuffs, partly because he has imagined that he got a double benefit out of the cake, etc., first as food, then as manure, and partly because he has known more about farmyard manure than about artificial fertilizers.

In an exact consideration of the question, it is, however, necessary to distinguish the two-fold actions 1) of the feeding stuffs as food and as manure, 2) of farmyard manure as fertiliser and as an ameliorator of the soil because of the humus it contributes.

It is now generally accepted that at the most one-half of the nitrogen contained in a feeding stuff reaches the land again in the dung. The point requiring most investigation is the amount and nature of the fertility added by cake feeding after allowing for the loss of about 50 per cent. of the nitrogen in the food. With this object in view, experiments were instituted at Rothamsted in 1904 on the relative crop-producing powers of equal weights of dung made with and without cake, in the year of their application and in the three subsequent years.

In a field containing eight series, two series of five plots each were arranged as follows:

	1	2	3	4	5	
A	No manure	1904 1908	1905 1909	1906 1910	1907 1911	Ordinary dung
B	1904 1908	No manure	1905 1909	1906 1910	1907 1911	Cake-fed dung

In each series there is a check plot which remains unmanured; the manure was applied each year to one plot only, the application of manure being renewed at the end of four years and so on. To obtain the dung for comparison, two sets of bullocks were set apart each year, one getting roots and hay only, the other the same plus 4 to 8 lbs. of cake or other concentrated food. The dung made was carted straight out to the land, or was made up into a heap for a month or so, and then well mixed; equal weights were put on the plots at the rate of 16 tons to the acre.

The chemical analyses of the two kinds of dung have given the following average composition:

Manure	Dry Matter	Nitrogen			
		Total	As ammonia	As amides, etc., soluble	Insoluble
From roots and hay only . . .	2.64	0.530	0.043	0.069	0.418
From roots and hay with cake.	2.66	0.701	0.147	0.118	0.436

It will be seen that as regards the insoluble compounds of nitrogen the two kinds of dung are much alike, but the cake-fed dung contans on the average more than double the amount of ammonia and amides.

The rotation adopted was alternating roots and corn: swedes, barley, mangolds, wheat. The results of nine years' experiments compared with the yield of the unmanured plot taken as 100 were the following:

Manure	Yield: total produce (unmanured plot = 100)			
	Year of application	Second year	Third year	Fourth year
	Mean of 9	Mean of 8	Mean of 7	Mean of 6
Dung from roots and hay only	134	123	114	106
Dung from roots and hay with cake	165	132	113	108

The principal conclusion which may be drawn from these experiments is that the extra value conferred upon dung by cake feeding is not of an enduring nature; the first crop gets most of the benefit, giving twice the increase of that getting common dung; in the second crop the ordinary

dung has given an increase of one-quarter, the cake-fed dung of one-third, while in the third and fourth years there is no difference.

It is evident that compensation for cake feeding should not be carried back for more than two years prior to the end of a tenancy.

These results suggest that on light arable land, where dung is of great importance and where (in England at present) bullock-feeding is unprofitable, the farmer will do better to feed his bullocks without cake, except such as is required to finish them off in the last month or so. In this way he may save £10 on the cake per acre of root land, while the nitrogen can be made up for 20 to 30 *s* by a dressing of sulphate of ammonia or other nitrogenous fertilizers; this method has the additional advantage that the extra nitrogen can be applied to whatever crop will best repay its use, instead of being necessarily applied in the dung to the roots.

The writer concludes that other experiments are desirable, experiments that involve, as those of the future are all likely to do, systematic account keeping as well as a record of yields, because there is a practical issue at stake which would affect the practice of many of the best farmers in the country, many of whom, the writer believes, are persisting in a method of obtaining fertility that once was good, but has now become unprofitable at current prices for feeding stuffs and store cattle.

16 – **On the Decrease of Available Phosphoric Acid in Mixed Fertilizers containing Acid Phosphate and Calcium Cyanamide.** — BRACKETT, R. N. (Chemical Department, Clemson Agricultural College, South Carolina) in *The Journal of Industrial and Engineering Chemistry*, Vol 5, No. 11, pp. 933-935. Easton, Pa., November 1913.

Complaints have been made by manufacturers on the disadvantages of using calcium cyanamide in the preparation of mixed fertilizers, especially in regard to the danger of diminishing the amount of assimilable phosphoric acid.

Laboratory experiments have shown that when cyanamide is mixed with superphosphate in the proportion of one part of the former to 6.25, 8.33, and even 9.8 parts of the latter, a gradual increase of insoluble phosphoric acid and consequently a decrease of the assimilable acid takes place; and this both in the simple mixture of superphosphate and cyanamide as well as in the presence of organic nitrogenous manures and of salts of potash.

Experiments made on a large scale by three manufacturers have also demonstrated that a decrease of assimilable phosphoric acid takes place when cyanamide and superphosphate are used in the preparation of mixed fertilizers at the rate of one part of the former to 6.25 or 8.33 of the latter.

The same danger of diminishing the assimilability of the phosphoric acid in compound fertilizers, when they contain calcium cyanamide and superphosphate, was confirmed by the analyses made by the fertilizer control service.

On the whole the experiments show that the factor time has an important influence in determining the insolubility of phosphoric acid, and must be taken into consideration, together with the factors represented by the increase of temperature which occurs during the mixing and by the alkalinity of the cyanamide.

In conclusion, it appears from the above that mixing cyanamide with superphosphate, while not injurious from the farmer's or purchaser's point of view, to the resulting compound manure, still requires special attention on the part of the manufacturer and vendor as to the quantity of cyanamide used, lest the manure be found on inspection and analysis to be deficient in avaible phosphoric acid.

17 — **The Degree of Fineness of the Lime used for Dressing Land.** — MEYER, D. in *Illustrierte Landwirtschaftliche Zeitung*, Year 33, No. 84, p. 755. Berlin, October 18, 1913 (1).

It is now well known that the degree of fineness of the ground limestone used as a dressing has a notable influence on its efficiency. Nevertheless there is no uniform understanding on the subject and consequently the commercial products do not present the same degree of fineness. Thus ten samples of ground limestone and two of calcareous marl taken as commercial samples by the Halle a. S. Experiment Station gave the results shown in the accompanying table.

No. of origin	Name	Degree of fineness					
		> 5 mm.	> 2 mm.	> 1 mm.	> 0.5 mm. (sieve No. 50) (*)	> 0.2 mm. (sieve No. 100 for basic slag) (*)	> 0.2 mm. (fine particles)
1	Ground limestone	0.80	1.55	9.63	23.38	13.17	51.47
2	"	4.12	5.45	17.66	23.12	12.10	37.55
3	"	0.00	0.00	0.20	14.76	22.04	63.00
4	"	0.00	0.15	17.95	28.63	13.26	40.01
5	"	0.00	0.00	7.78	21.24	14.88	56.10
6	"	0.00	0.00	0.00	4.05	21.41	74.54
7	"	0.00	2.15	9.24	21.79	20.32	46.50
8	"	0.00	0.00	0.00	0.32	9.66	90.02
9	"	0.00	0.00	0.16	0.43	4.38	95.03
10	"	0.00	0.00	1.11	26.52	17.48	54.89
11	Very soft calcareous marl	0.00	0.27	23.17	26.16	15.80	34.60
12	Fairly hard d°	0.80	9.30	13.90	22.81	14.24	38.95

(*) In wire sieves the mesh width is given by the diagonal.

(1) See also *Landw. Wochenschrift für die Provinz Sachsen*, Year 15, No. 43, pp. 355-356. Halle a. S., October 25, 1913. (*Ed.*).

The majority of these limestones have an insufficient degree of fineness, and it would be desiderable that the marls should be ground.

The writer accordingly proposes:

1. *a*) The content of fine meal (that passes through sieve No. 100 for basic slag) of the limestones and of the calcareous marls should be at least 70 per cent.

b) The portion remaining on sieve No. 100, but passing through sieve No. 50 should not be higher than 75 per cent. of the amount paid for as lime, and the proportion that passes through a sieve with 1 mm. round holes must not exceed from 25 to 50 per cent. of the above amount.

c) The portion above 1 mm. should be deducted.

2. It would be desirable that moist calcareous marls and limestones for meadows should be dried and if necessary ground before being used.

3. The various forms of lime must bear their proper designation: thus, for instance, ground limestone must not be sold under the name of calcareous marl.

Burnt lime is commonly used in lumps or ground. Lately so-called "Körnerkalk" has been put on the market; it is in pieces the size of peas or hazelnuts and is very convenient for spreading. The writer, however, believes that owing to the difficulty with which the pieces break up, it is advisable, when burnt lime cannot be applied in any other form, to use ground limestone instead of "Körnerkalk".

18 - **Sulphur and Pyrites used as Manure.** — VERMOREL, V. and DANTHONY, E. in *Journal d'Agriculture pratique*, New Series, Vol. 26, No. 47, pp. 651-653. Paris, November 20, 1913.

This article reports new experiments on the possible fertilizing action of sulphur, carried out in paraffin-wire pots filled with a soil carefully deprived of organic matter.

In one series of experiments nitrogen was given under the form of nitrate of soda, in the other as dried blood; the nitrogenous fertilizer was mixed with sulphur, and applied to the surface or mixed with the earth; the same was done with the controls without sulphur, all other conditions being equal. The results are shown in Table I (next page).

Summarizing: in the nitric nitrogen series the action of sulphur is practically nil, the differences observed being within the range of experimental error; on the other hand, in the organic nitrogen series considerable increases of yield have been observed, up to 30 per cent. with wheat and up to 60 per cent. with beans (haricots) when the larger quantity of sulphur was mixed with the soil. These results appear to confirm those obtained by Boullanger and Dujardin (1), namely that sulphur exerts little or no action without organic nitrogen, but acts energetically in the presence of organic matter.

In the same manner as with sulphur, Vaux pyrites containing 50 per cent. of sulphur were also tested, with the results shown in Table II.

(1) See No. 1397, *B*. Oct. 1912 (*Ed.*)

TABLE I.

Treatment	Weight of crop compared to that of control taken as 100			
	Manured with nitric nitrogen		Manured with organic nitrogen	
	Grain	Straw	Grain	Straw
Wheat				
Control	100	100	100	100
Sulphur as top dressing (of 44.6 lbs. per acre). . .	98	99	109	112
id. mixed with the soil (*id.* *id.*). . .	105	104	115	111
id. as top dressing (of 89.2 lbs. per acre). . .	102	103	121	111
id. mixed with the soil (*id.* *id.*). . .	104	104	130	162
Beans (haricots)				
Control	100	—	100	—
Sulphur as top dressing (of 44.6 lbs. per acre). . .	106	—	120	—
id. mixed with the soil (*id* *id.*). . .	100	—	150	—
id. as top dressing (of 89.2 lbs. per acre). . .	96	—	130	—
id. mixed with the soil (*id.* *id.*). . .	98	—	160	—

TABLE II.

Treatment	Weight of crop compared to that of control taken as 100			
	Manured with nitric nitrogen		Manured with organic nitrogen	
	Grain	Straw	Grain	Straw
Wheat				
Control	100	100	100	100
Pyrites as top dressing (89.2 lbs. per acre). . .	102	102	129	130
id. mixed with soil (*id.* *id.*). . .	100	100	120	118
id. as top dressing (178.4 lbs. per acre). . .	100	101	120	111
id. mixed with soil (*id.* *id.*). . .	101	100	141	176
Beans (haricots)				
Control	100	—	100	—
Pyrites as top dressing (89.2 lbs per acre). . .	104	—	142	—
id. mixed with soil (*id.* *id.*). . .	103	—	140	—
id. as top dressing (178.4 lbs. per acre). . .	98	—	125	—
id. mixed with soil (*id.* *id.*). . .	104	—	152	—

As with sulphur, the action of pyrites on nitric nitrogen has been next to nothing, while with organic nitrogen the increases in yield have been as high as 40 per cent. with wheat and 50 per cent. with beans. Thus pyrites also has no effect except in the presence of organic matter.

The advantage of using pyrites (1) deserves to be confirmed by experiments on a large scale.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

19 - **Research on Vegetable Physiology: II.** — MAZÉ, P. in *Annales de l'Institut Pasteur*, Vol. XXVII, No. 8, pp. 651-681. Paris, August 1913.

In the first part of this paper (2) the writer gave an account of his experimental methods for conducting water cultures under sterile conditions and concluded from his work on maize that plants have the power of excreting residual substances both through their roots and through their leaves In the present paper he adopted the same methods of water cultures, and, still working with maize, he examined the storage of mineral matter in the various plant organs.

His original food solution was made up as follows:

	gms.
Sodium nitrate	0.6617
Ammonium sulphate	0.514
Potassium phosphate (neutral)	1.0
Magnesium sulphate + 7 Aq	0.2
Ferrous sulphate + 7 Aq.	0.1
Zinc chloride	0.05
Potassium silicate	0.05
Manganese chloride	0.05
Calcium carbonate	2.0
Tap water	1000

This he calls P×1, and others in which the nitrogen is provided by one single compound become P×1 $NaNO_3$, P×1 $(NH_4)_2SO_4$, P×1 NH_4NO_3, etc.

Twenty plants were grown in solutions of various strengths and with their nitrogen supplied under different forms; their ash content was estimated in the various plant organs (Table I). The ash content of the leaves varied little with regard to both the age of the plants and the strength and composition of the solutions employed, while that of the stems and roots reflected more markedly differences of age and of food supply. The total ash content of the plants in the solutions in which the nitrogen was provided in the form of sodium nitrate was higher than that of those in which the nitrogen was provided in the form of ammonium sulphate or ammonium nitrate.

(1) See No. 918, *B.* Aug. 1913 (*Ed.*).
(2) See No. 3108, *B* Nov.-Dec. 1911. (*Ed.*).

TABLE I.

No. of plant	Culture solution	Age of plant	Dry weight	Ash per 100 dry matter		
				Stems	Leaves	Roots
		days	gms.			
1	P × ¼	25	2.975	12.31	12.83	—
2		31	4.330	10.75	11.65	14.73
3		45	9.480	7.79	7.90	10.39
4		53	8.560	8.57	8.54	8.70
5	P × ½	25	2.12	16.24	11.11	—
6		31	3.21	17.23	12.62	—
7		45	13.32	17.35	10.12	13.11
8		53	14.38	11.60	11.77	12.38
9	P × 1 $NaNO_3$	25	1.875	20.06	14.40	—
10		31	2.10	18.50	14.66	—
11		45	13.73	20.24	12.00	21.18
12		53	9.39	18.84	12.03	16.10
13	P × 1 NH_4NO_3	25	1.07	15.35	13.95	—
14		31	2.01	13.82	13.46	—
15		45	17.29	22.73	11.83	14.04
16		53	8.07	15.65	12.14	13.75
17	P × 1 $(NH_4)_2SO_4$	—	10.975	18.97	11.76	12.68
18		—	8.630	15.81	11.58	12.92
19	P × ½ $(NH_4)_2SO_4$	—	10.665	13.81	11.64	7.81
20		—	8.26	9.63	11.20	14.53

In a further set of experiments 6 plants, after being developed in a complete food solution, were transferred to incomplete solutions for a certain length of time and then analysed for ash content. Here again there was an attempt to keep the ash content of the leaves constant and approximately the same as in the previous experiment, but this was done at the expense of the stems and roots, which were seriously depleted.

After removal of all plants for analysis, the solutions remaining in the jars were measured and tested for acid or alkaline reaction. The writer discusses the changes undergone by the solutions during the growth of the

plant, and looks upon the results as confirming his previous work on the exosmosis of roots.

Absorption of complex organic substances by maize roots. — Nine plants were raised in various complete food solutions which were later replaced by solutions containing complex organic substances. (Table II).

TABLE II.

No. of plant	Complete food solution	Organic solution	Containing organic matter per litre	No. of days in org. solution	Org. matter absorbed by the plant	Dry weight of plant
			gms.		gms.	gms.
1	P × 1 NH_4 Cl	Starch paste . . .	4.492	43	7.694	41.34
2	P × 1 NH_4 Cl	Peptone Chapoteaut	3.842	43	2.926	33.01
3	P × ½ NH_4 Cl	Peptone + NH_4 NO_3 0.5 p. 1000 . . .	3.829	43	6.488	48.41
4	P × 1 $(NH_4)_2$ SO_4	Humus + $NaNO_3$ 0.5 p. 1000 . . .	0.866	41	2.035	—
5	P × ½ $(NH_4)_2$ SO_4	Humus + potassium phosphate 0.5 p. 1000	0.682	41	1.626	30.76
6	P × ½ NH_4 Cl	Distilled water . .	—	54	—	28.80
7	P × ½ $(NH_4)_2$ SO_4	» » . .	—	52	—	26.95
8	P × ½ NH_4 Cl	Saccharose	50	25	26.843	40.41
9	P × ½ $(NH_4)_2$ SO_4	»	20	25	17.568	31.70

At the end of the experiment the organic matter remaining in the solution was estimated, and from that the amount absorbed by the plant was calculated. All plants in the organic solutions produced more dry weight than those in distilled water. Those in the sugar and peptone solutions presented a peculiar appearance : the leaves of the former assumed an upright position, and the sheaths rolled up as if to avoid the light; on the other hand the leaves of the peptone plants lost their turgescence and elasticity, and hung down along the stems. The roots of these same peptone plants ramified abundantly, and developed more especially in the air space above the level of the solution in the flask, the extremities dipping into the solution 2 or 3 cm. and following the level down gradually as the solution evaporated. The ash content of the 9 plants showed, with two exceptions, the same characteristics as that of the plants in previous experiments : *i. e.* the percentage in the leaves remained high and fairly constant at the expense of the

roots and stems. The two exceptions were the plants fed on sugar and peptone discussed above, in which the normal functions of the plant were evidently interfered with.

The Law of the Minimum and the Law of Physiological Relationship. — Returning to the 2nd set of experiments, it may be remarked that the 5 plants in the incomplete solutions did not make as much growth as the one in distilled water. The writer points out that incomplete solutions must therefore have a retarding action and suggests as an explanatory hypothesis his Law of Physiological Relationships, which supposes that for each plant there exists a certain combination of the nutrient elements which gives optimum results and that any disturbance of this balance produces ill effects on the plant. To test this hypothesis further a food solution was made up having a strength A, and with it 5 culture solutions were prepared:

1. $A \times \frac{1}{4}$
2. $A \times \frac{1}{4} +$ the potassium phosphate contained in $A \times 1$.
3. $A \times 1$
4. $A \times 1$ » » » $A \times 1.5$.
5. $A \times 1.5$.

The resulting plants are shown in a photograph, where 3 is distinctly the largest, followed by 1 and 5, while 2 and 4 are evidently suffering from the effects of some inhibiting factor. The Law of the Minimum, according to which growth is limited by the amount of one particular element which may happen to be deficient, fails entirely to account for these results, while the Law of Physiological Relationships affords a more satisfactory explanation of facts. The writer continued his researches on the subject, using *Aspergillus niger* and Raulin's solution of various strengths in which the nitrogen supply was thrown out of balance and increased to 16 or 32 times the normal amount. In every case the fungus made less growth on the unbalanced solution than on the balanced solution, whether the latter were weak or strong. Similar results, however, were not obtained when potassium phosphate was added in excess instead of nitrogen.

20 - **The Water Requirement of Plants in the Great Plains.** — BRIGGS, LYMAN J. and SHANTZ, H. L. — *U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin* No. 284, pp. 7-48, plates I-XI. Washington, D. C., October 1913.

This investigation was carried out to determine the differences in water requirement of the more important crop plants and some of their varieties, with a view to determining the most suitable plants for the semi-arid conditions of the Great Plains. The water requirement of a plant, or its transpiration ratio, is obtained by dividing the weight of total water absorbed by the total dry weight of the plant or by the weight of grain. Its value varies with changes in the temperature and humidity of the air, velocity of wind, intensity of solar radiation and fertility of the soil. In order to control these factors the experiments were carried out in a

screened enclosure with a capacity for 200 pots arranged in 5 rows running east and west. The walls of the enclosure to a height of 3ft. consisted of tight boards. A strip of thin cheese cloth 3ft. wide, supported on both sides by wire netting, was placed immediately above the boards. This did not interfere with the ventilation of the enclosure, but it served to break the force of high winds. Measurements with a silver disc pyrheliometer showed that the reduction in the direct radiation of the sun due to this screen amounted to about 26 per cent. at 10-30 a. m. Experiments with tumble weeds (*Amaranthus graecizans*) inside and outside the enclosure showed that the difference in water requirement between the two series was less than the probable error of observation. Later experiments, however, with more succulent plants like wheat and alfalfa, have shown that the screening effect of such an enclosure reduces the water requirement in a measurable degree. Since the determination of the *relative* water requirement of the different crop plants is the main problem, it was considered necessary to eliminate such factors.

The pots were made of heavily galvanized corrugated iron, 40 cm. in diameter and 66 cm. high, and had a capacity of about 250 lbs. (115 kg.) of soil. Each pot was fitted with a heavy galvanised iron cover through which holes were punched suitable in size and number to accomodate the particular crop which it was desired to grow. The joint between the can and the cover was sealed with a strip of surgeons' adhesive plaster 2 inches wide. Care was taken to have the soil at the top of the plots built well up so as to be in firm contact with the cover. A special arrangement for supplying the necessary water was fitted into the centre of the cover, as it was found that supplying the water at the bottom of the vessel caused stagnation of the lower portion and increased the value of the transpiration ratio considerably.

The seeds, after germination, were planted through the openings in the cover of the pot and covered with light moist soil to the level of the cover. The exposed soil was then protected from evaporation by means of a layer of wax consisting of a mixture of 8 parts of pure beeswax and 2 parts of tallow. The seal was thickened as the plants became established. This method of preventing evaporation and excluding rain proved most satisfactory, especially with small grains.

The daily weighings were made upon a spring balance reading to 0.1 kg. The balance was checked frequently by means of a standard weight kept for the purpose. The plants were cut at the stage when similar crops were harvested in the field, and the cropping was weighed green and after drying to constant weight at 110° C.

Each pot was weighed soon after the seeds were planted and again immediately after the crop was harvested. The weight of water supplied during the experiment minus the difference between the final and initial weighings gives the total weight of water absorbed by the plant. This method of calculation is subject to two errors, which balance each other to some extent, *viz.* a value too high by the amount of the dry weight of the tops and a value too low by an amount equal to the green weight of the roots. The

TABLE I. — *Based on dry matter produced.*

Crop	Variety	Water requirement of variety	Water requirement of species	Relative compared with wheat = 100
Alfalfa (lucerne) .	Grimm	1068±16	1068	211
Pea, field	Canada	800±17	800	158
Artemisia frigida .		765 ± 24	765	151
Rye.	Spring	724±7	724	143
Sweet clover (melilot)		709±9	709	140
Oats	Burt	639±7	614	122
	Swedish Select	615±7		
	Sixty-Day	605±5		
	Canadian	598±14		
Buckwheat. . . .		578±13	578	114
Barley.	Beardless	544±9	539	106
	Beldi	543±2		
	White Hull-less	542±3		
	Hannchen	527±8		
Wheat.	Emmer	534±14	507	100
	Marvel Bluestem	531±5		
	Spring Ghirka	506±3		
	Galgalos	496±4		
	Kubanka	468±8		
Potato	Irish Cobbler	448±11	448	88
Rape		441±12	441	87
Sugar Beet . . .	Kleinwanzleben	377±8	377	74
Corn (maize) . . .	Iowa Silvermine	420±3	369	73
	Northwestern Dent	368±10		
	Esperanza	319±5		
Weeds.	*Amaranthus retroflexus*	356±4	322	63
	Salsola pestifer	336±5		
	Amaranthus graecizans	275±7		
Sorghum.	Dwarf Milo	333 3	306	60
	White Durra	321±2		
	Brown Kaoliang	301±3		
	Red Amber	298±4		
	Blackhull Kafir	278±5		
Millet	Kursk	287±2	275	54
	German	263±15		

TABLE II. — *Based on grain produced.*

Crop	Variety	Water requirement of variety	Water requirement of species	Water requirement relative, compared with wheat = 100
Pea, field	Canada	2218±100	2218	163
Rye.	Spring	2215±37	2215	163
Oats.	Canadian	2204±140	1680	124
	Sweedish Select	1632±35		
	Burt	1500±57		
	Sixty-Day	1383±30		
Wheat.	Marvel Bluestem	1786±60	1357	100
	Spring Ghirka	1382±43		
	Galgalos	1245±13		
	Kubanka	1191±14		
	Emmer	1180±42		
Barley.	White Hull-less	1475±40	1244	
	Beardless	1210±38		
	Beldi	1155±18		
	Hannchen	1134±27		
Buckwheat. . . .		1037±33	1037	76
Millet	Kursk	923±40	923	68
Sorghum.	Dwarf Milo	1123±57	790	58
	White Durra	806±12		
	Blackhull Kafir	803±26		
	Brown Kaoliang	726±12		

water requirement of each pot is determined separately and the mean of six determinations is taken to represent the water requirement of the plant under investigation. This procedure also afforded a basis for calculating the probable error of the mean determination.

The results of the experiments with various crops are summarised in Tables I and II.

These results show that field crops differ considerably as regards their efficiency in the use of water. Alfalfa (lucerne) for example uses four times as much water as millet and sorghum in the production of a pound of dry matter. Corn (maize) ranks next to sorghum and millet in efficiency. The water requirement of the small grain crops is approximately twice that of millet, but only half that of alfalfa.

Varieties of the same crop also show measurable differences in their

water requirement, suggesting the possibility of developing strains of greater efficiency and more suitable to arid soils than those now grown.

The water requirements of the different weeds gave unexpected results. *Artemisia frigida* (mountain sage) is a native plant, and, being covered with a dense silvery pubescence, from a morphological point of view it would appear to be admirably adapted to a dry country. Its water requirement, however, is 765 $\pm$ 24 and as the plant grows very slowly it has a very low degree of efficiency in the use of water. There would appear to be little connexion between the morphology, degree of succulence and the water requirements of a plant.

Determinations of the water requirements of wheat were made under field conditions by means of an extensive series of soil sampling carried out daily throughout the experiments. The rainfall absorbed by the soil was computed from the daily moisture determination. The water requirements of Kubanka wheat obtained in this were 700 and 862 for the seasons 1910 and 1911 respectively, while figures obtained in the pot experiment were only 468. If, however, we deduct the amount of rainwater absorbed by the soil from the above determination, the amount of stored water removed by the wheat in the open field becomes 486 and 466 for the two years, results which agree with the pot determinations. This shows that wheat is able to make little direct use of light rains during a dry season when the roots are obtaining their matter from the lower depths.

Experiments with wheat and sorghum at Akron (Colorado) and at Amarillo and Dalhart in North Texas also gave interesting results. The evaporation from a free water surface in North Texas during the growing season of wheat was 18 per cent. higher than that at Akron. The water requirement of sorghum was practically the same in the two regions (356 and 359), while the water requirement of wheat averaged 36 per cent. higher in North Texas. Thus sorghum is relatively better adapted to Texas and wheat is relatively better adapted to Colorado.

21 – **The Occurrence of Aluminium in Plants.** — KRATZMANN, E. (Pflanzenphysiolog'schen Institut der K. K. Universität in Wien) in *Sitzungsberichte der K. Akademie der Wissenschaften, math.-naturwiss. Klasse*, Vol. CXXII, Part II, No. 1, pp. 311-336 + figs. 6. Vienna, 1913.

The writer first tested the various methods for the micro-chemical determination of aluminium, observing that for the researches on plants the element is to be determined as double sulphate of aluminium and caesium; the sensibility of the reaction is 0.3 μ gm. Following this method, 130 plants belonging to various families were tested for aluminium. The results showed that this element is widely spread in the vegetable kingdom, and that some plants are so rich in aluminium that they may be called "aluminiphilous". Nevertheless the presence of aluminium in plants is not connected with their taxonomic position; there are remarkable differences in the same genus and also individual deviations. In several cryptogams, aluminium concentrates in the fertile tissues, and also among angiosperms it often accumulates in the flowers. Lastly, it appears that plants

possess a specific elective power towards aluminium, for of two plants of different species grown quite close to each other on the same soil, one may accumulate much aluminium and the other none.

22 - **A Study of the Methods of Estimation of Carbohydrates, especially in Plant Extracts.** — DAVIS, W. A. and DAISH, A. J. (Rothamsted Experimental Station) in *Journal of Agricultural Science*, Vol. V, Part 4, pp. 437-468. Cambridge, October 1913.

During an investigation of the carbohydrates present in the mangold leaf now in progress, the writers made a special study of the methods of analysis applicable in such cases. They detected certain errors which are likely to occur in this class of work and describe a new method for the estimation of maltose in presence of other sugars.

23 - **Analysis of Willow Ashes.** (Bericht über die Tätigkeit der landw. Kreisversuchsstation für Mittelfranken in Friesdorf für das Jahr 1912, Year IV). — KLEEMANN in *Landwirtschaftliches Jahrbuch für Bayern*, Year 3, No. 11, pp. 622-628. Munich, 1913.

With the object of determining the basis of a possible manuring for willows, complete analyses of the ash of various parts of two kinds of willow were made, besides determinations of the nitrogen content. These data were hitherto lacking in the literature on the subject.

Percentage to dry matter.

	Part	Nitrogen	Ash	Silica	Phosph. pentoxide	Chlorine	Sulphuric anhydride	Carbon dioxide	Ferric oxide and alumina	Lime	Magnesia	Potash	Soda
Salix viminalis (gathered in the middle of September)	Leaves.	2.59	7.93	0.71	0.12	0.13	0.82	1.22	0.08	2.41	0.97	1.22	0.15
	Bark	1.31	3.61	0.05	0.04	0.01	0.18	0.82	0.04	1.24	0.34	0.87	—
	Wood	0.42	1.04	0.04	0.06	0.01	0.04	0.21	0.02	0.29	0.14	0.37	—
Salix amygdalina (gathered in the middle of September)	Leaves	2.73	6.08	0.40	0.06	0.12	1.02	0.07	0.07	1.04	0.74	1.72	0.05
	Bark	1.37	3.38	0.05	0.03	0.01	0.15	0.02	0.02	0.93	0.33	0.94	—
	Wood	0.39	1.07	0.03	0.04	0.01	0.05	0.02	0.02	0.20	0.10	0.36	—

24 - **The Stomatal Characteristics of Sugar Cane.** — DUNLOP, W. R. in *West Indian Bulletin of the Imperial Department of Agriculture for the West Indies*, Vol. XIII, No. 4, pp. 314-323, + plates I-II. Barbados, September 1913.

A large number of different varieties of sugar cane were examined under field conditions with regard to those characters of the leaves affecting the rate of transpiration, *viz.* manner of curling, motor cells and woody tissue, frequency and size of stomata, etc.

The following conclusions were arrived at:

a) The morphological and anatomical characteristics of the leaves of each variety are so definite as to provide a ready means of identification.

b) Stomatal density per unit area is one of the chief characteristics, but does not appear to be correlated with other leaf characters such as size

of leaf, size of individual stomata, and total area of foliage, though small stomata are often numerous and *vice versa*.

c) There appears to be some correlation between susceptibility to drought and the ratio of the total stomatal area to the total area of foliage, but this point requires further investigation.

d) The manner of curling is probably more important in limiting the effective action of the stomata than the stomata themselves. It is correlated with the ratio between the stomatal densities of the two leaf surfaces, with the anatomical structure (motor cells and woody tissue) and with the erect position of the leaf. This correlation between leaf habit and stomatal charateristics appears to affect the distribution of varieties in cultivation.

e) The greatest stomatal area was associated with a very high sugar content.

The writer suggests that more attention should be paid to the habit and stomatal characteristics of the leaf in selection for drought resistance in sugar cane.

PLANT BREEDING.

25 – On the Importance of the Structure of the Ear in the Selection of Maize. — FLEISCHMANN, REZSŐ in *Köztelek*, Year 23, No. 89, pp. 3012-3013. Budapest, November 15, 1913.

In selecting the ears of maize, growers as a rule only take into consideration the pure line and the percentage of cob and grain in relation to the whole ear. There are, however, certain other essential characters which should not be lost sight of. One is the number of rows, which may vary from 8 to 26 or even more in the case of the Horsetooth variety.

The importance of this character is demonstrated by observation on specimens of the above-mentioned variety, selected on the Ruma (1) estate; these showed that the weight of grain per ear increases regularly with the increase in the number of rows from 8 to 22.

The result of selection in increasing the number of rows in the crop is shown in Table I.

TABLE I.

Year	Parents	Number of rows of grain in offspring											Average number of rows of grain in all the ears
		8	10	12	14	16	18	20	22	24	26		
1909	Original plants selected in the field	0.7	5.2	39.8	41.2	10.8	2.0	0.3	—	—	—	—	13.0
1910	Line No 127 (16 rows) . .	—	—	7.8	29.0	38.2	17.2	5.5	—	—	1.5	0.8	15.9
1911	127/1910 (16 rows).	—	—	6.0	47.8	29.8	11.9	4.5	—	—	—	—	15.2
1912	127/1911 (18 rows).	—	—	7.1	17.9	34.6	32.2	5.9	2.3	—	—	—	16.4

(1) See No. 928, *B.* Aug. 1913. (*Ed.*).

The result was that the ears of 1912 had an average of 3 or 4 rows more than the original material of the first year.

In the number of seed-rows of the ears selected on the Ruma estate, the average of the ancestors varies about the figure 14, and the experimental data relating to the 1912 harvest indicated in Table II show that the offspring revert to this mean.

TABLE II.

No. of lines	No. of rows of grain in parents	Average No. of rows of grain in the ear of each generation
Plot No. I:		
13	14	14.04
20	16	14.58
5	18	15.56
2	20	16.23
1	22	17,31
Plot No. II:		
1	12	13.40
9	14	14.21
34	16	14.78
4	18	15.29
1	22	15.94
1	26	17.25
Plot No. III:		
7	12	13.92
24	16	15.01
6	18	15.32
8	20	15.88

According to these data the average number of rows of seeds in the offspring of the many-rowed parent ear is greater than the average of those from the fewer-rowed parent ears, but the average of the first approaches more nearly the average number of rows of the whole group (*i. e.* 14) than the number of rows in the parent ear. This character can only be fixed by prolonged and continued selection.

The results obtained in the pedigree selection on the Ruma estate during five years show that there is in the majority of cases a correlation between productivity and the number of seed-rows, as shown in Table III, in which the original plants of 1912 are divided into three groups according to the number of rows of their descendants of the first generation.

TABLE III.

Plot	No. of rows of parents		
	14	14-15	more than 15
	kg.	kg.	kg.
I (43 ears)	8.16	8.50	8.85
II (34 ears)	6.15	6.33	6.48
III (40 ears)	6.89	7.50	7.10

The ears of the high-cropping types had, except in certain cases, the greatest number of seed-rows.

The number of seed rows in the ear is also correlated with other characters. With increase in the number of rows the tips of the seeds are narrowed and become elongated, while the percentage of rachis in the ear decreases. The following results were obtained by the writer :

No. of rows	8	10	12	14	16	18	20
Percentage of rachis in the ear .	20.6	16.7	14.4	14.3	15.4	15.3	14.9

These observations show that in the selection of maize or the improvement of the yield considerable importance should be attached to the number of seed-rows. At the same time the other characters must not be lost sight of. Further, the quantity and quality of the seeds, and the structure of the seeds, and the structure of the rachis are also important factors in the analysis, a thickened rachis being correlated with a low yield. Also a thick rachis contains more pith, which takes longer to dry and deteriorates quicker, especially during a wet season. The heredity of this character is shown in the following table:

Percentage weight of rachis in selected types at Ruma.

Type No.	181	288	127	204
1909 - Parent ears	8.9	11.0	15.9	17.1
1910 - 1st generation	11.7	10.4	14.4	15.3
1911 - 2nd »	13.2	13.3	14.7	16.3

OT CROPS.

26 - ***Tacca umbrarum*, a Starch-producing Plant in Madagascar.** — FAUCHÈRE, A. in *Journal d'Agriculture tropicale*, Year 13, No. 148, pp. 316-317. Paris, October 1913.

Tacca umbrarum ("Tavolo") grows wild on the eastern slope and in the interior of Madagascar. It produces tubers the size of a fist and sometimes

even as large an ostrich's egg. The natives of some provinces use them as food, either cooked whole or as flour extracted by primitive methods.

The plant grows in soil of varying fertility. The fresh tubers yield about 30 per cent. of dry marketable flour. This plant will probably soon be cultivated and may become an important source of starch.

27 – **The Oil Palm.** — *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. V, No. 10, pp. 256-257. Antwerp, October 1913. OIL CROPS.

The oil-palm (*Elaeis Guineensis*) is the source of palmetto-oil and palm-oil. The former is used in the preparation of vegetable butter, for which there is an ever increasing demand. The latter is in request by soap-manufacturers, being the most suitable fat for their purpose. The price of palm-kernels, which 20 years ago was 8*s* to 10*s* per cwt., has now reached 24*s* to 26*s*.

The introduction of this African palm into Asia has given very encouraging results. Its growth is satisfactory and the yield and richness of the fruit are superior to those in Africa. Experiments show that one acre of these palm trees yields more than 2500 lbs. of palm-oil, producing a profit of £ 24 per acre. The cost of establishing and maintaining till bearing begins reaches £ 32 per acre. These trees come into bearing in four years.

In the province of Tamiang in Sumatra, preparation has been made for planting 7 500 acres per year.

28 – **Gru-Gru Palm Kernels *(Acrocomia sclerocarpa)* in Trinidad.** — *Department of Agriculture, Trinidad and Tobago, Bulletin*, Vol. XII, No. 74, pp. 137-138. October 1913.

The gru-gru nut is widely distributed throughout Trinidad, but not in sufficient abundance for the development of an export trade. It is used locally as a roasted nut. Analyses at the Imperial Institute gave the following results.

Kernels	per cent.
Moisture	6.1
Fat (yellowish white, crystalline)	57.0

Analysis of fat compared with palm-kernel oil.

	Gru-gru fat	Palm-kernel oil
Specific gravity	0.867	0.8731
Acid value (1)	1.3	—
Saponification value (2)	253.7	242.4 to 254.8
Iodine value, %	16.2	10.3 to 17.5
Hehner value	88.5	91.1
Insoluble fatty acids, %	88.1	—
Unsaponifiable matter, %	0.41	—
Volatile fatty acids, soluble (3)	5.7	5.0 to 6.8
» » insoluble	12.6	—

(1) Milligrams of potash per gm. of oil.
(2) Cubic centimetres of N/10 alkali required to neutralise acid from 5 gms. of oil.
(3) Reichert-Meissl-Wollny number.

These gru-gru kernels should realise about the same market price as oil-palm kernels (£23 per ton), and should find a ready market if offered in shipments of from 50 to 100 tons.

RUBBER, M AND RESIN PLANTS.

29 - **The Rubber Crisis.** — 1. TILMANT, J. in *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. V, No. 10, pp. 247-256. Antwerp, October 1913. — 2. ZIMMERMANN, E. in *Deutsche Tageszeitung*, No. 572, 2nd. Supplement. Berlin, November 10, 1913.

M. Tilmant summarises various views brought forward by journals, reviews and other authorities on the present rubber crisis and its possible solutions. Protection is of particular importance in its relation to wild rubber.

Brazil. — A reduction in price does not affect the production till the following year. The quantity harvested depends on the credit of the "aviadores" and the means which they possess of sending workmen into the forest. They have suffered considerably this year owing to the fall in prices, and it seems doubtful if they will be in a position to finance the usual number of workmen next year.

The following measures have been adopted for improving the situation: Reduction of export duties by half; suppression of all duties and taxes on plantation rubber; construction of railroad; to reduce cost of trasports; construction of refining stations, so that only first quality products are exported.

Belgian Congo. — The export duty of 1.75 francs per kilo (7½*d* per lb.) has been removed. It is hoped that recourse to bounties will be avoided by the following means: Reduction of freight charges by rail and sea; more careful collection of the tax, which is at present too frequently evaded; increasing the tax on underselling pedlars.

French Equatorial Africa. — Export duties have been lowered from 0.60 franc to 0.30 franc per kilo (2¼*d* to 1½*d* per lb.). Including the reduction on the cost of transport by the Belgian Congo railway and the steamship companies, the total reduction on rubber in the French possessions amounts to 0.70 franc per kilo (3 *d* per lb.).

German Colonies. — In *East Africa* the most important question is the organisation of labour. The period of indenture should be increased from one to three years, in order to reduce the loss of time and money to the coolies, the owners and the colony. According to Dr. Zimmermann, the cost of production can be lowered by increasing the output of the workers and the purity of the product. An expert coolie should easily harvest a quantity of latex equivalent to 900 grammes of washed rubber; at a market price of 3.5 marks (1*s* 6*d* per lb.) this will give a profit of £30 per ton. The reduction granted by the steamship companies has lowered the freight from 90 marks (£4 10*s*) to 65 marks (£3 5*s*) per ton. The reductions by the railway companies amount to 50 per cent. Unfortunately the total reduction represents only about ½*d* per lb. *Kamerun* asks for the abolition of the export duty of 1 ¾*d* per lb.

30 – A New Method of Tapping Manihot. — *Der Pflanzer*, Year 9, No. 9, pp. 473-475. Daressalam, September 1913.

M. Migdalsky, director of the Prinz Heino Plantation, Morogoro, E. Africa, has discovered a method of diminishing the expense of tapping Manihot trees. Lewa's method of rolling into balls involves considerable hand-labour, and has been modified as follows: a piece of cloth about 28 inches long and 4 inches broad is soaked with a solution of vinegar and applied to the incision in the bark ; the cloth is then drawn upwards in close contact with the tree. The latex adheres to the cloth and is coagulated in the form of a small pellicle, which is easily detached:

This method has distinct advantages.

1) Fewer incisions are required compared with the older method and the trees can be tapped more frequently.

2) The rubber is pure and can be cleaned by hand, one workman being able to clean 60 lbs. per day.

3) The operator does not require the same skill as with the older method.

4) The yield of the labour is considerably increased. Unskilled workmen have produced in one day the following quantities :

a) by the old method (in balls). . . . . $8\,^1/_2$ oz.

b) by the new method . . . . 28 oz.

31 – Tobacco in the French Colonies. — PRUDHOMME, EM., in *L'Agronomie Coloniale*, Year 1, Nos. 1-4, pp. 1-7, 42-52, 68-75 and 104-111, + 3 maps and 2 plates. Paris, Juliy-October, 1913. VARIOUS CROPS.

In 1910 a " Permanent and Interministerial (Finances and Colonies) Commission on Colonial Tobaccos " was appointed to investigate methods of improving the cultivation of tobacco in the French colonies and to inform planters of the best methods available. This Commission came to the following decisions:

1) To undertake a detailed study of the different varieties of tobacco actually grown in the colonies.

2) To enable planters to obtain good seed and technical advice, and to purchase their produce on trial through the Ministry of Finance.

3) To train a qualified staff, by organizing at the Ecole Nationale Supérieure d'Agriculture Coloniale a complete scheme of instruction, theoretical and practical, on the cultivation and preparation of tobacco.

Present State of the production of tobacco in the colonies, according to the report of the Commission.

Dahomey. — This tobacco is characterised by perfect combustibility, fine texture and low nicotine content, generally less than 1 per cent. These qualities make it probable that Dahomey can produce large leaf tobacco. For native consumption the coarser American varieties might be tried, such as Black Virginia and Kentucky, as preferred by them.

Guinea. — In this colony the tobacco is consumed particularly as snuff and chewing twist. In Camayenne crops of tobacco of good quality have been produced suitable for the manufacture of French pipe tobaco. Yel-

low Orinoco Virginia has shown itself superior in its mildness and good combustibility.

Senegal. — The production in this colony is not sufficient for local consumption and large quantities are imported from America.

Equatorial Africa. — Tobacco is cultivated chiefly in the immediate neighbourhood of the villages of the Oubangui-Chari-Tchad and the Middle Congo; in the latter district it gives rise to a considerable trade. Owing to its defective market condition, the French Administration will not accept it, although its combustibility is recognised as very satisfactory and its nicotine content is low, not exceeding 1.8 per cent.

Réunion. — This island already exports tobacco, but not to France. There is a commercial movement of considerable importance which produces about £16 000. The chief variety cultivated is Langue de Boeuf, which has stiff lanceolate leaves with fine veins and resistant tissue. It is grown chiefly as an intercrop with sugar-cane in alternate lines with about 3 500 plants per acre. In order to reduce the strength of the tobacco and increase the fineness of the leaf for European consumption, it seems desirable to adopt a closer system of planting.

The preparation in Réunion comprises the following processes: 1) desiccation, 2) picking and sorting, 3) rolling, 4) pressing 5) cutting. Picking consists in removing the midribs of the leaves. Rolling includes sorting into bundles of about 26 lbs. The rolls are then submitted to a strong pressure and tightly bound. The tobacco thus undergoes fermentation in small heaps.

Cultivation experiments carried out at the St Denis Botanic Gardens (Réunion) have shown that it is possible to obtain: 1) tobaccos (variety Szamoshat) possessing such fineness of texture and colour as to resemble well-known leaf tobaccos; 2) cut tobaccos (especially Maryland) of average strength and without a characteristic taste; unfortunately these tobaccos (except Maryland) smoke so badly as to be almost unusable.

The Commission considers that investigations should be carried out on improvements in combuibility.

32 – **Turkish Tobacco in the Cape Province.** — STELLA, L. M. in *The Agricultural Journal of the Union of South Africa*, Vol. VI, No. 4, pp. 617-636 + plates L-LXIII. Pretoria, October 1913.

Since 1906 the government has conducted experiments on the cultivation of Turkish tobacco in the Cape Province. These experiments have been carried out on private farms in charge of an officer. The progress in the cultivation during the last seven years is shown in the following table.

The low price of the last year's crop is attributed to the unmatured state of the tobacco, which, not being in a suitable form for storing, had to be sold rapidly to unwilling buyers. The local demand for this tobacco is estimated at about half a million pounds per annum, so that with improved methods of preparation and marketing, this industry has considerable possibilities of further development. With this object in view the "Western Tobacco Growers' Company, Ltd." was formed in July 1912, and a scheme of rules

Year	No. of farms on which experiments were carried out	Area	Yield	Average price per lb.
		acres	lbs.	s d
1906-1907	6	7 ½	3 000	1 6
1907-1908	12	25	13 000	1 11
1908-1909	14	70	16 000	2 0
1909-1910	18	113	56 000	2 1
1910-1911	24	250	140 000	2 1 ½
1911-1912	32	400	250 000	1 6 ½
1912-1913	42	525	—	—

and regulations were drafted. A warehouse has since been opened and the solution of the profitable marketing of Turkish tobacco appears to be in sight.

33 – **The Cultivation of the Rose Geranium and its Present and Future Economic Conditions.** – CHARABOT, EUG. and GATIN, C. L. in *Journal d'Agriculture Tropicale*, Year 13, No 148, pp. 289-295. Paris, October 1913.

The writers wish to suggest the cultivation of the rose geranium (*Pelargonium odoratissimum*) to planters. They emphasise the effect of climatic and soil conditions on the quantity and quality of the essence. Small trials should be made at first and the cultivation only continued in those places where it gives perfect results.

34 – **Note on a Lemon-Grass from Fiji.** — KNOWLES, C. H. *Department of Agriculture, Fiji, Bulletin* No. 6, pp. 4. Suva, 1913.

The writer gives the results obtained at the Nasinu Experiment Station with a lemon-grass (*Cymbopogon coloratus* Stapf.), introduced in 1907 from India. The most favourable time for harvest is when the plant has reached 3 or 4 feet in height before the flowering period is advanced. The percentage of oil in the young plants is greater than that of the old ones, but the total yield obtained is less. Thus a plot cut four times produced only one-third of the quantity of oil obtained during the same time from a similar plot cut only once after reaching 4 feet in height. The estimated yield of oil is 43 lbs. per acre per cutting.

Distillation experiments show that the process should not continue longer than 4 hours, because the amount of essence produced after this time is unprofitable. The profits per acre should reach £2 per cutting, and two or three harvests are obtainable in the year.

35 - **A Perfume Plant from West Africa: *Popowia Capea.*** — *Bulletin scientifique et industriel de la maison Roure-Bertrand Fils de Grasse,* 3rd Series, No. 8, pp. 3-17 + 4 plates. Grasse, October 1913.

Popowia Capea, or "capé", is a shrub belonging to the Anonaceae. The natives of the Ivory Coast crush it into cold water to perfume their baths. The dried stems and leaves are sold at about 1 franc the kilo (4 ½ *d* per lb.) M. and Mlle. Camus have made a complete botanical study of the species, which is given in the Roure-Bertrand bulletin (1).

The dried leaves give 59 per cent. of oil; of this, 35 per cent. is heavier than water, and the rest lighter; the first part may be called the heavy portion and the second the light portion. The accompanying table gives the analysis.

	Complete Essence	Heavy portion	Light portion
Specific gravity at 20°	1.00416	1.00808	0.99596
Polarimetric deviation	+ 76° 56'	+ 90° 54'	+ 51° 26'
Solubility in 80 % alcohol	1 vol. then cloudy	1 vol. then very cloudy	1 vol. then very cloudy
Solubility in 95 % alcohol	0.5 vol., then very slightly opalescent.	1 vol., from 3 vols. marked opalescence	0.5 vol., then very slightly opalescent.
Index of acidity . . .	2.8	1.5	3.7
Saponification value .	166.1	192.3	123.2
Saponification value of acetylated essence .	239.9	248.3	218.4

This essence is thus especially distinguished by its high density, its high dextro-rotary power and the high proportion of saponifiable matter.

36 - **On the Anatomy of the Seed of *Abrus precatorius* ("Jequirity") and of the Seeds Used to Adulterate it.** — BARIOLA, ROSA in *Atti dell'Istituto Botanico dell'Università di Pavia,* 2nd Series, Vol. XVI, pp. 16, plates I-V. Pavia, 1913.

The writer, following up the preliminary note published at the end of 1912 (2), discusses at length the morphology and anatomy of the seed of *Abrus precatorious* ("Jequirity") and of the seeds of other Leguminosae (*Rhynchosia precatoria* =*R. phaseoloides* DC., *Adenanthera pavonina* L. and *Ormosia dasycarpa* Jacks.) used in the adulteration of "Jequirity".

(1) See also N. 214, *B.* Jan. 1912. (*Ed.*).
(2) See. No. 262, *B.* March 1913. (*Ed.*).

MARKET GARDENING.

37 – **The Forcing of Spanish Iris.** — *The Gardener's Chronicle*, Vol. LIV, No. 1404, pp. 357-358. London, November 22, 1913.

Spanish Irises (*Iris Xyphium*) cannot be forced like most bulbs, but can only be induced to flower a few weeks earlier. Boxes 12 to 15 inches square and 3 to 4 inches deep are most suitable for the purpose. No leaf mould or manure is required, but the top layer of a well-manured and limed soil is required and it should be sterilised by steam or chemicals before use. The bulbs are pressed into the soil until they are ½ inch below the edge of the box, and covered to a depth of 3 or 4 inches with ashes. The temperature of the house should be maintained equable at about 45° F.

Experiments with several varieties gave the following results:

Variety	Cold House		Warm Hause		
	First bloom ready	Remarks	Date of housing	First bloom ready	Remar k
Belle Chinoise . . .	June 23	Intense yellow Good growth	Jan. 19	Apr. 20	Fair
Blanche Fleur. . . .	May 29	Good growth	Jan. 19	Apr. 22	Good
Louise	May 27	Good Pale blue	March 20	May 10	Good
Alex. von Humboldt.	—	—	Jan. 19	May 10	Bad
British Queen. . . .	May 24	Good Pure white	March 20	May 10	Good
Count of Nassau . .	May 28	Good. Blue	Feb. 26	May 26	Good

A box of each of the above varieties was kept at a temperature of 60° to 65° F. The buds came up plump and healthy and then withered in spite of ample supplies of water; this suggests that these bulbs have not sufficient latent vitality to develop under hard forcing.

FORESTRY.

38 – **Forest Protection in Canada.** — Forest Protection of the Dominion. — *Communicated by* T. K. DOHERTY, *Commissioner for the International Institute of Agriculture in Canada.*

Roughly speaking, Canada has a forest area of 781 000 square miles. But in spite of the fact that the country possesses such great areas of timberland it has been recognised within recent years that the supply was being rapidly depleted. This depletion was due not so much to the legitimate utilization of timber as to the enormous waste caused by forest fires and inefficient lumbering methods. As a result of this, the governments of the several provinces, as well as the Federal government, wisely undertook to put a stop to these losses. At the present time all of the provinces which possess forests have some form of legislation looking to the protection of their timberlands from fire.

In order to show the progress that has been made, as well as what may yet be attempted, the Commission of Conservation has, through its forester, Mr. Clyde Leavitt, just completed a report on forest protection in Canada. The report gives a resumé of what has been accomplished through the operation of the well known order No. 16570 of the Board of Railway Commissioners, respecting the prevention of forest fires along railway lines. It further points out the splendid progress that has been made by British Columbia in holding the number of forest fires in that province to a minimum and explains the working of existing legislation on the prairies in Ontario, Quebec and the Maritime Provinces.

A special feature of the report is the discussion of the brush disposal problem in lumbering operations. In this regard the experience of the United States in preventing fires in national forests, as well as the work that is being done by the Western Forestry and Conservation Association is fully explained. The working of the topping law as applied to the forests in the Adirondacks is also covered fully. The use of oil fuel by railways in regions subject to forest fires is given considerable attention, and the opinions of the officials of railways using oil are quoted copiously. A section of the report is also given over to a discussion of forest planting in Canada.

The report as a whole should prove to be a valuable source of information to those who are interested in conserving Canada's forests.

39 – **The Palmyra and Dum Palms in West Africa.** — DE GIRONCOURT, G. in *Annales de la Science agronomique*, Year 30, No. 4, pp. 408-419. Paris, October 1913.

The wood of the Palmyra palm (*Borassus flabelliformis*) is very valuable for building on account of its large dimensions and rigidity. Its popularity leads to unfortunate results, for its utilization for European buildings takes precedence over the numerous uses of the leaves and fruits, so that there is danger of its extinction in the parts of the Sudan bordering on the Sahelian zone (upper Senegal and Niger).

The natives make use of the pericarp only; the kernels, which constitute one-third of the weight, may be used as a substitute for coroso, and a price of £ 16 per ton has been offered for them at Hamburg.

Certain precautions must be observed before a marketable production can be obtained. The nuts should be gathered soon after their fall to prevent germination, and the kernels must be thoroughly dried before opening, to prevent mould. At present two concessions have already been sought in West Africa.

The writer also deplores the disappearance of the dum palm (*Hyphæne thebaica* var. *oethiopica*) (1) from the Upper Niger region, owing to its careless exploitation for use with steam engines. An example from south of Timbuctoo shows remarkable results from careful reservation of this tree. The Governor of Togo, Count Zech, has proved without doubt the possibility of checking this careless exploitation by inculcating a better appreciation of this tree amongst the natives, thereby encouraging its planting and promoting the development of the colony.

(1) See No. 2714, *B.* Aug.-Sept.-Oct. 1911. *(Ed.)*.

LIVE STOCK AND BREEDING.

HYGIENE.

40 - **Malignant Oedema in Sheep.** — EHRLICH in *Landwirtschaftliche Wochenschrift für die Provinz Sachsen,* Year 15, No. 47, pp. 387-388. Halle a. S., November 22, 1913.

The writer gives a short description of Koch's oedema bacillus, the cause of the above disease, which occurs in Germany under the forms of a purulent inflammation of the vagina and uterus, an inflammation due to injuries during shearing, and as an inflammation resulting from dog bites or infection during castration. The following preventive measures and remedies are recommended.

1. Affection of vagina and uterus: segregation of lambing and sick ewes, which should be kept scrupulously clean; the injection of oxydizing disinfectants into the diseased parts.

2. Inflammation of shear-wounds: disinfection of the wounds with benzine and a solution of pyoktaniniodine tincture (to be prescribed by the veterinary) immediately after shearing.

3. Inflammation from other wounds: thorough disinfection of the wounds after castration.

ANATOMY AND PHYSIOLOGY.

41 - **Studies of the Endogenous Metabolism of the Pig as Modified by Various Factors.** — MC. COLLUM, E. V. and HOAGLAND, D. R. (Laboratory of Agricultural Chemistry, University of Wisconsin) in *The Journal of Biological Chemistry*, Vol. XVI, No. 2, pp. 299-326. Baltimore, November 1913.

Pigs were fed on a nitrogen-free diet of carbohydrates, salts, and water. The urine was collected daily, and the amount of nitrogen present under the form of creatinine, creatine, ammonia, and urea, as well as the total nitrogen, was estimated.

On a diet of starch and alkaline salts the total nitrogen output attained its minimum value; the creatine content was constant and approximately equal to 18.5 per cent. of the total. When the alkaline salts were replaced by neutral salts the total nitrogen rose immediately owing to an increased output of ammonia, while the urea and creatinine remained approximately constant; the same effect was obtained by feeding hydrochloric acid.

The substitution, wholly or partially, of starch by fat in the diet had no effect on the total nitrogen output, while the total creatine (creatinine + creatine) was in one case increased and in another decreased, possibly owing to the fact that one animal was receiving neutral salts, while the other received basic salts. Finally, the addition of up to 16 gms. daily of benzoic acid to the diet had no permanent effect on the output of total nitrogen, ammonia or creatinine, but the urea was decreased and the writers are of opinion that the nitrogen lost in this form is converted into hippuric acid.

FEEDS FEEDING.

42 - **New Method for Calculating the Value of Foods from the Point of View of the Production of Milk.** — HANSSON, N. in *Meddelande No.* 85 *från Centralanstalten för Försöksväsendet på Jordbruksområdet, Husdjursafdelningen* No. 12.

During the last quarter of last century the method for calculating the nutritive value of the various fodders on the basis of their chemical composition which prevailed in agricultural literature was little followed by Scandinavian breeders. It was too complicated, and moreover experience had shown that the values calculated did not always correspond to their effect; this was especially noticed in comparing coarse fodders (hay and straw) with concentrated foods.

In 1887, in Denmark, feeding experiments were undertaken with the object of determining the proportions in which the various foods could replace each other in a practical feeding ration for cows without affecting their production. In the economic control of dairies carried out by the control associations the relative values thus found and expressed in "food units" were increasingly used, especially for the practical calculation of rations. The number of these associations has increased to such an extent since the beginning of the century, that they at present exert a directing influence on animal husbandry in Sweden as well as in Denmark. On the other hand the experience gained by the work of control has contributed to confirm and in some cases to correct the relative values of all the common foods.

The correctness of the values in food units was later confirmed by Kellner's starch values, which, like the values in forage units, were a measure of the total effect of the fodders. One food unit corresponded on average to 0.605 kg. (1.33 lb.) of starch value, but there were exceptions; thus the starch value of foods rich in carbohydrates, such as coconut and maize cakes, was equal or even superior to that of cakes rich in protein, whilst the value of these latter in food units, based on feeding tests, was decidedly superior.

This difference is further confirmed by numerous feeding experiments which in Sweden have included 52 different foods. (Summarized in *Fühlings Landw. Zeitung*, 1909-1913). With the aid of the results of these tests, the writer has shown the cause of the differences between the two methods of calculating the relative values of foods. By means of the results of tests made with cakes and soya meal, he was already able to show in 1909, that for milk production protein in quantities greater than the necessary minimum had, in comparison with nitrogen-free substances, a value superior to that found by Kellner in his experiments with fattening animals.

This conclusion was confirmed by feeding experiments conducted by the writer from 1910 to 1912 with peas, vetches and beans. He replaced quantities equal in food units, giving 2 kg. (4.4 lbs.) of a mixture of equal parts of earthnut cake, bran and wheat instead of the same quantity of the ground pulse above mentioned, that is to say that 1.12—1.16 kg. (2.46-2.55 lbs.) of starch value in the mixture of cake and bran are replaced by 1.33-1.38 kg. (2.93 to 3.04 lbs.) of starch value in the pulse, and yet in five series of experiments the latter gave an average production of milk and of fat inferior to that yielded by the mixture of cake and bran. Thus the

starch value did not prove an exact measure of the feeds used for the production of milk.

According to the writer, this difference between Kellner's starch values and the Swedish and Danish food-unit values depends upon the fact that Kellner's figures are the result of fattening experiments with steers, whilst the Swedish food-unit values are founded on experiments with milch-cows. In other words the starch values serve to measure the value of the various foods from the phint of view of the formation of fat, while the food units consider them from that of the production of milk. Fats, carbohydrates and crude fibre have the same value in the two cases, but protein is more advantageously used in the production of the milk proteins than in the putting on of fat.

It must be considered that the calorific value of the proteins of the fodder is so well utilized in the formation of similar bodies in the milk, in the foetus and in the digestive liquids, that the effective value of the digestible protein of the fodder in relation to that of the digestible carbohydrates corresponds to the full calorific value of the protein.

The writer's calculations have verified the correctness of this opinion, as when he reckoned the digestible protein of the fodder at 1.43 (correspond ing to the total calorific value of the protein) instead of at 0.94 (Kellner's figure), the calculated values corresponded to those which resulted from the feeding experiments. The writer has thus introduced a method for calculating the milk- producing value which only differs from Kellner's method for the calculation of the starch value as regards the figure for the reduction of protein.

The following is an example of such a calculation for earthnut cake, the total relative value of which was 98.

Digestible protein		$39.6 \times 1.43 = 56.6$
Digestible fat		$7.2 \times 2.41 = 17.4$
Nitrogen-free extract	21.2	$21.9 \times 1.00 = 21.9$
Digestible cellulose.	0.7	
	Total . . .	95.9

$$\frac{95.9 \times 98}{100} = 94.0 \text{ kg. (206.8 lbs.) of milk-producing value.}$$

The effect of 1kg. (2.2 lbs) of digestible carbohydrates is thus the unit of milk-producting value, as it is of starch value.. The difference between these two notions is that the starch value considers protein only according to its effect on fattening, while the milk-producing value expresses the effect of fodder in the case in which all the calorific energy of the proteins is utilized for the production of milk. The two values are very nearly the same for fodders poor in protein, the difference being insignificant for hay, green food and cereals, but more marked for pulse and cakes rich in protein. The principle of recognizing in foods rich in protein a feeding-value higher than their starch value is not opposed to Kellner's opinion on the starch value, as he calculates the money value of the foods on the basis of a fundamental price, not only per kilogram of starch value but also per kg. of protein.

The table given on the neet page gives the necessary figures for calculating

Milk-producing value of foods.

	Content of digestible matter					Value for the production			1 Food unit = kg. of fodder	Ratio of milk-producing unit to food unit = 1 to:
							per 100 kg.			
	Protein	Starch	Fat	Nitrogen-free extract	Fibre	Total relative value (Wertigkeit Kellner)	Starch value	Milk-producing value		
Earthnut cake	39.6	1.4	7.2	21.2	0.7	98	74.9	94.0	0.8	0.75
Sunflower cake	28.7	2.6	10.3	19.0	3.5	95	70.6	83.9	0.9	0.76
Coconut cake	12.5	0.4	7.1	29.9	9.4	100	68.2	74.3	1.0	0.74
Barley	6.5	1.0	1.7	6.7	1.4	99	72.0	75.2	1.0	0.75
Mixture (½ barley, ½ oats)	7.4	1.0	2.7	52.1	1.9	97	67.4	68.2	1.1	0.75
Oats	7.7	1.0	4.0	44.7	2.3	95	59.6	63.2	1.2	0.76
Peas	17.2	3.0	0.9	48.8	2.5	98	68.0	76.2	1.0	0.76
Vetches (seed)	20.0	2.9	1.6	45.8	2.8	96	65.9	75.3	1.0	0.75
Clover hay	5.5	3.0	1.7	26.0	11.3	70	32.0	33.9	2.2	0.75
Mixed hay (clover and grasses)	4.2	1.5	1.1	25.3	12.1	67	29.1	30.5	2.5	0.76
Meadow hay	4.2	1.3	1.0	24.3	15.5	64	29.2	30.5	2.5	0.76
Barley straw	0.7	0.2	0.5	19.0	21.3	45	18.9	19.0	4.0	0.76
Mangolds	0.4	0.6	0.1	7.4	0.7	87	7.5	7.7	10.0	0.77
Swedes	0.5	0.5	0.1	8.1	0.8	87	8.3	8.5	9.0	0.77
Turnips	0.4	0.5	0.1	5.2	0.7	87	5.7	5.9	12.5	0.74
Green food (oats and vetches)	1.4	0.8	0.3	4.9	2.3	80	7.3	7.8	10.0	0.78

the milk-producing values, as well as the values of the foods usually employed in the feeding of live stock. In order to institute a comparison, the writer has also inserted the starch values and the quantities equal to a food unit according to the scale employed in Sweden. The conformity of these units to the new values is shown by the figures of the last columns. As is seen in the last column, one food unit is generally equivalent to about 0.75 of the new values, that is to say that in a mixture of fodders satisfying the protein requirements of cows and calculated according to the above-mentioned method, 1 kg. of barley, 1.1 kg. of the dry matter of roots, or quantities of other foods according to 0.75 kg. of milk-producing value, are to be considered as one food unit. As the digestible carbohydrates which serve as unit of this valuation are used on an average for direct produc-

tion with only 3.6 calories per gramme, one food unit contains about 2.7 calories utilizable for the production of milk. In order to satisfy the requirements as to protein, the food unit must contain 100 gms. of digestible protein in the maintenance ration and 135 gms. in the productive ration.

The writer's method of calculation has removed one difficulty which was much felt in the valuation of the various fodders necessary in the control calculations required at dairies. The values of food units are all based on feeding experiments made with fodders of average quality and are only applicable to such fodders. But in practice it often happens that fodders of superior or inferior quality have to be used. In such cases, there has not been hitherto any method for determining exactly the nutritive value. Roots may be valued on the basis of their content in dry matter, which is almost entirely digestible and of equal nutritive value. It is especially in the case of coarse fodders which have a higher and more varied content of undigestible fibre that a base has been wanting for the valuation of nutritive value.

By means of the new method of calculating the milk-producing value of fodders, this difficulty has been overcome and such a valuation may also be made for fodders of the most varied composition, provided their content of digestible matter is known. By this possibility of determining the nutritive value of fodders on the basis of chemical analysis, the Scandinavian valuation by food units, which was hitherto purely empirical, has received a scientific basis.

43 - **A Study of the Correlation between Racing Performances and Breeding Value in Brood Mares.** — ROBERTSON, J. B. in *The Bloodstock Breeders' Review*, Vol. II, No. 9, pp. 185-197. London, October 1913. BREEDING.

The writer attempts to ascertain whether there exists any association between a mare's racing ability and her power to produce offspring possessing high-class racing qualities. With this object in view he has extracted from the Racing Calendar the performanecs of the dams of the winners of the

	Dams of 189 classic winners 1862-1913	Dams high class performers	Random sample of 1000 brood mares G. S. B. Vol. XXI.
	per cent.	per cent.	per cent.
GROUP I. — Never ran	14.8	21.2	36.5
GROUP II. — Ran, but showed no form .	13.2	13.7	29.5
GROUP III. — Showed moderate form . .	20.6	20.0	14.5
GROUP IV. — Fair winners	25.4	26.3	16.6
GROUP V. — Good winners	13.8	10.8	2.5
GROUP VI. — High-class race mares . . .	12.2	8.0	0.4

Derby, Oaks, St. Leger, and Two Thousand and One Thousand Guineas during the last 30 years and classified them. The result of these investigations is given in the first column of the accompanying table. In the second column are given the dams of racehorses which were not three-year-old classic winners, but yet were high-class performers. In the third column are included 1000 mares of the General Stud Book (G. S. B.) taken at random. Thus the performance of the dams of winners and high-class performers can be compared with the average performance of brood mares of the G. S. B.

It will be seen from the above table that over 12 mares in every hundred which have bred classic winners, were either classic winners themselves or very high-class race mares, whereas in the General Stud Book there are only 4 mares in every hundred which could be so described. Considering the first two groups of the table it will be seen that 66 per cent. of the mares in the General Stud Book either never ran or showed no form, as against 28 per cent. of the dams of classic winners. In fact whichever group be examined the result points to the conclusion that the chance of breeding a clasic winner is very much greater from those mares which have racing per formances to their credit than from the others.

44 – **Colour Inheritance in Swine.** — SMITH, W. W. in *American Breeders Magazine* Vol. IV, No. 2, pp. 113-123, Washington, D. C., 1913.

As a result of 12 matings between pigs of the white Yorkshire breed and of the black Berkshire or Poland China breeds, 115 individuals were obtained, all white. Crossbred Yorkshire × Berkshire of the F_1 generation were mated together and produced 26 pigs of which 20 were white and 6 black splashed with white, while crossbreds mated with Berkhire gave 65 pigs of which 32 were white and 33 black with some white. All the recessive blacks of the F_2 generation carried more white than the original black parent.

The offspring of a white $^3/_4$ Poland China sow by a Poland China sire, consisting of 21 individuals, could be divided into four classes, *viz*:

11 black with a little white;
2 white » » black;
1 half white and half black;
2 all white.

These results show the complete dominance of white over black in the generation and a general tendency for the original parent colour to be expressed separately in the F_2 generation in the proportion of 3 dominants to 1 recessive. But the fact that in nearly all cases the recessive black of the F_2 generation carried more white than the original black parent suggests that each colour may be made up of a number of germinal factors rather than of a single factor.

WORK OF LIVE-STOCK ASSOCIATIONS AND OTHERS FOR THE ENCOURAGEMENT OF BREEDING.

45 - **Stock-Breeding in Tripolitania. The Export of Stock and of the Products of the Stock-Breeding Industry.** — *Ministero delle Colonie, Bollettino di Informazioni*, Year 1, No. 4, pp. 163-206. Rome, October 1913.

Stock Production and Export. — The annual production of cattle in Tripolitania amounts to 50 000 head. The animals are exported to Malta and Sicily. In 1907 and 1910, Italy imported Tripolitan cattle to the value of £968 and £57 140 respectively.

These animals are small, powerful, strongly built, and average 660 lbs. in weight; before the war they fetched about £6 per head. The Orfella and Gebel breeds are considered the best; the former are good milkers, and the latter excellent draught animals. The milk yield of an Orfella cow during a six months' lactation period is reckoned at 220 to 260 gallons. The cattle would be more profitable, if provision were made for water and fodder during the dry season, and due attention paid to the castration of unsatisfactory bulls, selection, the increase of the herds, and the control of cattle diseases. In order to increase milk production, the cows should be rigorously selected, and they should be supplied with green forage during a longer period of the year. Cattle are sold for ready money at the market, and either at a valuation, or according to their live weight.

The number af horses bred annually amounts to 10 000 and the value of those exported every year is estimated at about £4000. Of these exported animals, one-third go to Malta and two-thirds to Sicily. The Turkish Government used to encourage horse breeding by prohibiting the export of brood mares and, at times, that of stallions also. The best horses are produced in the districts of Tarhuma and Orfella; only stallions come into the market. To promote and improve horse breeding, suitable measures should be adopted, such as better keeping, careful selection, and perhaps the establishment of stud-stations and other similar reforms.

Asses are much bred in the interior, about 50 000 being produced annually. The Tripolitan ass is usually black and stands 10 hands high on an average. It is an excellent worker, and its average price is £1 12 s.

The annual production of sheep is estimated at 100 000. Of the exported sheep 10 per cent. go to Malta, the rest almost exclusively to Egypt. Three breeds are distinguished: the Orfella sheep, the fat-tailed Gebel sheep, and the large woolless Sudan sheep. The Tripolitan sheep is exported as a rule for its mutton, but is also exported frequently to Malta and Sicily for breeding purposes. In Tripoli, where fat is employed for seasoning, the fat-tailed breed is predominant. The average weight of these animals is 77 lbs.; the rams weigh 88 lbs., and lambs at 4 to 6 months 40 lbs. The milk yield during the lactation period, which lasts 3 or 4 months, amounts to 4 ½ gallons. The sheep are very heat-resistant and fairly prolific; on account of the numerous diseases which prevail, they have rather poor fleeces. In order to improve them, it would be necessary to induce the natives (to whom all the flocks belong) to pay more attention to the management of the animals, and to castrate and fatten all unsatisfactory rams. Crossing with European breeds would, at present, be useless. The average price in Tripoli per head is £1, for rams £1 4s and 16s to £1 for lambs.

Goat keeping is very general in Tripolitania; the breed is of average size, and the animals are black. Their live weight amounts to 66 to 88 lbs. A kid at 2 to 3 weeks old weighs 11 to 15 lbs. Cloth is made from the shorter finer hair, and ropes from the longer. Under favourable conditions, a goat gives 1 3/4 pints of milk daily; the milk yield of the whole lactation period amounts to 13 to 33 gallons. The natives prefer to mix the goats' milk with ewes' and cows' milk when making butter and cheese. The breed could be improved by better feeding, systematic organisation of the the sale, and rigorous selection of the animals.

Tripolitania possesses two important breeds of fowls: the Arab and the Turkish. The first are good layers; they are chiefly kept in the interior of the country and fowls are often sent to Malta and fetch 4*d* per lb. The Turkish fowl is somewhat larger and fattens better, but is not such a good layer as the Arab. The hens weigh 4 ½ lbs. and the cocks 5 ½ lbs. Other breeds of poultry are little kept in Tripolitania.

The Production and Export of Animal Products. — The annual native production of hides is valued at £26 000; one quarter is used in the country, and the remainder is exported. France and America are the best customers, after which come Greece, Turkey and Asia Minor. The skins are dried in the shade, and then treated with a 4 per cent. solution of potassium arsenate. Goat skins are worth, on an average, 1*s* 7*d* each, cow and ox hides £2 16*s* 5*d* to £3 12*s* 7*d* per cwt. and camel skins from £1 8*s* 3*d* to £1 16*s* 3*d* per cwt. Many hides and skins fetch lower prices, because they are dirty, contain holes, or are attacked by diseases (especially warbles). Prices are highest in summer and autumn, as a rule, and lowest in spring and winter. The skins from the Sudan are exclusively those of goats, and are brought by caravans to Tripoli. This trade was at one time of much importance, but is now insignificant, owing to establishment of water and railroad communication. From 1887 to 1896 the average annual value of the skins exported from the Sudan was £32 000; to day it is still £12 000. The goat skins are tanned in the Sudan, and usually dyed red or yellow for the market. The natives use for tanning vegetable substances such as "gedari", "afs-el-battum", "adze", "burbu" and pomegranate bark. The natives select in Tripoli those skins which are destined for export to America. They take the average weight of 12 skins as a criterion; this should be between 11 and 13 lbs. Delivered on board ship at Tripoli such skins fetch from 1*s* 5*d* to 1*s* 7*d* per lb. The goat skins are chiefly exported to Boston, for which port they are made up into bales, each containing 25 doz. In Boston, the skins are thoroughly tanned, and then sold to be made into boots, etc. So far, the attempt to introduce Sudanese skins into the European markets has met with no success.

Before the war, the annual wool production of Tripolitania amounted to 3 300 000 lbs., while 1 760 000 lbs. were exported, 1 320 000 lbs. being sent to France and 440 000 to Italy. The production depends upon the supply of forage, and in years of drought is scarcely sufficient to meet home requirements. The wool is coarse; it is unequal, except in the best flocks, and is usually grey or black, and often speckted with white, but rarely pure

white, and its quality is inferior. During the sale season, *i. e.* from April till July, unwashed wool fetches 3 ½ *d* per lb., and washed wool 7 ¼ *d* to 8 ¼ *d*. The principal markets are Marseilles and Genoa; after these come Triest and Malta. Marseilles offers the advantage of a more ready sale, Genoa that of greater net profit. Bengasi wool is better, and consequently somewhat dearer than the Tripoli product.

Formerly, Tripoli exported annually about 250 tons of bones, valued at £720; this export does not now exceed 120 tons, estimated at £600. Of these bones 90 per cent. are cow and sheep bones, while 10 per cent. are those of horses and asses. Most of the bones exported go to France and Italy.

Before the war, the egg export trade was of considerable importance. From 9 to 10 million eggs were exported annually, of which about half went to Italy. Italy was a customer in the spring and winter, France in January and February, while eggs were exported to Tunis in the summer, and to Malta throughout the year. The price varied in winter (including the cost of packing) from 9*s* 6*d* to 11*s* 10*d*, and in summer between 7*s* 11*d* and 8*s* 8*d* per 1000, at the harbour of Tripoli.

46 - **Studies in Milk Records.** — (1) GAVIN, W. The Interpretation of Milk Records. — *Journal of the Royal Agricultural Society of England*, Vol. 73 (1912), pp. 153-174. London, 1912. — (2) ID. The Influence of Fœtal Growth on Yield. — *Journal of Agricultural Science*, Vol. V, Part 3, pp. 309-319. Cambridge, 1913. — (3) ID. On the Accuracy of Estimating a Cow's Milking Capability by her First Lactation Yield. — *Ibid.*, Vol. V, Part 4, pp. 377-390. Cambridge, 1913. CATTLE,

1. The writer, who holds the position of Scientific Expert to Lord Rayleigh's Dairy Farms, has made a statistical study of the milk records of 2665 cows accumulated in the course of 24 years. He points out that in studies of the inheritance of milk yield in cows, it is difficult to assign a definite numerical value to the inherent milking capacity of each individual, as such figures as total yield per calf or per calendar year, average per week, etc., are subject to wide fluctuations from external causes; to make them of value, it is necessary to enumerate in every instance the particular circumstances in which the cow in question has been placed during the given period. In a statistical study this is naturally impossible, hence the necessity of defining a cow's milking capability by one single unqualified figure.

He classifies the external circumstances affecting yield under the following headings:

1) Age of cow.

2) Number of weeks in milk.

3) Number of weeks rest before calving (*i. e.* since the end of the previous lactation period).

4) Interval between calving and subsequent service.

5) Time of year of calving.

6) Food, weather and general treatment.

He then proceeded to select a figure which should be affected by the minimum number of factors and to estimate as accurately as possible the

effect of those influences under which it does fall. After a preliminary examination of the data, three figures were selected for comparison:

I. Average yield per day from the 5th to the 12th week after calving, or A.

II. Maximum yield on any one day, or M.

III. Revised Maximum, being the maximum day-yield reached or exceeded three times in any given lactation (*i. e.* the highest figure common to three entries in the record book), or R. M.

These figures should be outside the influence of the external factor, 2), and little effected by 4). The writer proceeded to compare their variability, and also their correlation with lactation totals, or L. T. (total yield per calf) both in normal and abnormal lactations. (Table I).

TABLE I.

	Abnormal (short)	Normal Lactations			Abnormal (long)	All Lactations
Weeks in milk	30–34	35–45	40–45	41–45	55–60	
No. of cows	167	1 233	696	590	172	2 665
Variation coefficients:						
L. T.	26.45	25.72	25.28	25.46	26.76	31.69
A.	25.98	25.78	26.77	27.13	28.54	27.56
R. M.	26.08	24.77	—	26.11	—	26.44
M.	25.83	24.68	25.55	25.05	28.32	26.08
Correlation with L. T.:						
A.	+ 0.885	+ 0.858	+ 0.879	+ 0.878	+ 0.873	
R. M.	+ 0.831	+ 0.844	—	+ 0.876	—	
M.	+ 0.823	+ 0.839	+ 0.869	+ 0.876	+ 0.832	

From this table it would appear that M is the least variable function of a cow's milk-production and that all the correlation coefficients seem high enough to justify the use of any of the three above figures as determinants of a normal cow's yield. The mean A, R. M., and M. were all calculated for the different lactation periods given above and showed very little variation. There was if anything a slight tendency to rise with the length of the lactation, but the point requires more investigation.

Now of the three figures A would be exposed to greatest error from those influences which are general in character and tend to act in the same direction for considerable periods, such as temperature, time of year, food, method of feeding, rainfall, housing, etc.. ; for during an unfavourable period which would depress A, it might well occur that on one day favourable circumstances combined to allow the cow to show what her real capability was, while in a lactation period where the conditions were favourable A would be increased while M. would remain the same. On the other hand records based on a single entry are liable to serious errors such as late milking, extra food, clerical mistakes, etc... To avoid both extremes the writer finally selected the R. M. as the most suitable unit; it possesses the further practical advantage over A. of requiring no calculation. He then estimated to what extent the R. M. was influenced by certain disturbing factors:

Influence of Age. — The mean R. M. for 110 cows was as follows:

Mean R. M. with	1st calf	or mean	$R.M_1.$ =	9.8 quarts
»	2nd	»	$R.M_2.$ =	12.8 »
»	3nd	»	$R.M_3.$ =	14.4 »
»	4th	»	$R.M_4.$ =	15.3 »
»	5th	»	$R.M_5.$ =	15.8 »
»	6th	»	$R.M_6.$ =	16.0 »

When these values were plotted, the curve was smoother than that obtained from the L. T. of the same 110 cows or than that of calendar year totals of 125 other cows. The maximum is not reached till the 6th calf, but there is little increase after the 4th calf. The writer suggests a rough correction for estimating the mature capability of a cow from $R.M_1$ RM_2, $R.M_3$, but the subject is discussed in detail in a subsequent paper.

Influence of season of calving. — The mean R. M. for cows calving in each month of the year was calculated on a total of 1418 cows and is given in the following table (II).

The highest means of R. M. occur with cows calving in April and May, and the lowest in August calving cows, corresponding to the supply of natural succulent food. Mean monthly L. T. of 731 of the cows with normal lactations showed very similar variations, but maximums occurred with cows calving in November and December, and then gradually decreased till August. The writer tried various corrections to reduce the error due to season of calving and finally suggests the following, which proved the most suitable as a provisional measure.

For cows calving April and May . . .	Deduct	5	per cent.	from	R. M.
» July . . .	Add	5	»	to	»
» August. .	»	10	»	»	»

Influence of period of rest. — 347 cows were divided into four groups according to the number of weeks rest they had before calving, and the mean R. M. for each group was estimated. The figures were practically identical, so no correction need be made on the R. M. on this account.

TABLE II.

Month of calving	No. of Records	Mean R. M.	Deviation of monthly mean from mean for year
		quarts	
January	136	14.3	+ 2.1 per cent
February	175	14.6	+ 4.2 »
March	104	14.7	+ 5.0 »
April	73	15.5	+ 10.7 »
May	87	15.3	+ 9.3 »
June	139	13.2	— 5.7 »
July	153	12.7	— 9.3 »
August	112	11.5	— 17.9 »
September	67	14.8	+ 5.7 »
October	125	14.4	— 2.9 »
November	104	13.8	— 1.4 »
December	143	13.8	— 1.4 »
		Mean 14.01	

2. — In this paper are given the results of an investigation into the influence of the time of service on R. M. 1419 records were first examined to determine the time after calving at which the maximum yield first occurs. The records were divided into five groups according to whether the cows calved in (I) April to November inclusive, (II) December, (III) January, (IV) February, (V) March, and tabulated according to the time which had elapsed between the time of calving and the date of maximum day yield (Table III).

It will be seen that 84 per cent. of the total number of cows reached their maximum day yield by the 8th week after calving, 92 per cent. by the 12th week and 97 per cent. by the 16th week. Three-quarters of the 8 per cent. that had not reached their maximum by the 12th week were January and February calvers, leaving only 2 per cent. for cows calving during the remainder of the year. Taking the Jan. and Feb. calvers by themselves, only 72 per cent. of the former gave a maximum before the 12th week, but 97 per cent. had given it by the 20th week. February calving cows alone shew corresponding figures of 74 per cent. for the 12th week, and 100 per cent. for the 20th. When these figures are plotted in curves superimposed on one another according to

TABLE III.

Percentage of cows reaching maximum day-yield during:

Date of calving	Weeks after calving							No. of records.
	1st to 4th	5th to 8th	9th to 12th	13th to 16th	17th to 20th	21st to 24th	25th to 28th	
April to November	67.5	29	2	0.5	0.5	—	0.5	862
December	55	27	10	0.5	3.5	4	—	141
January	40.5	28	3.5	12.5	12.5	3	—	136
February	41.5	15	17.5	24.5	1.5	—	—	176
March	23	31.5	38.5	7	—	—	—	104
All months	57	27	8	5	2	1	—	1419

TABLE IV.

Average daily yields.

Weeks after calving	No. of weeks after calving when served					
	5th to 8th	9th to 12th	13th to 16th	17th to 20th	25th to 28th	37th to 40th
3rd and 4th	100	100	100	100	100	100
(Average daily yield in quarts)	(14.8)	(14.1)	(13.7)	(14.0)	(13.3)	(13.2)
5th—8th	97*	99	99	98	98	97
9th—12th	88	90*	86	90	89	88
13th—16th	81	82	77*	82	77	79
17th—20th	73	73	69	73*	71	71
21st—24th	63	66	63	66	67	64
25th—28th	*52*	59	58	61	63*	60
29th—32nd	*40*	*50*	*51*	55	59	56
33rd—36th	*23*	*34*	*40*	*47*	56	51
37th—40th	—	—	—	—	48	47*
41st—44th	—	—	—	—	*35*	45

* Period of service.
Time after which the foetal growth appears to influence the yields is entered in italics.

their calendar dates, it becomes evident that the delayed maxima are in every case reached about the same season of the year, namely April and May, when the cows respond to the extra stimulus of abundant and succulent green food.

247 records of cows calving in May and June were then examined to determine the influence of the time of service. The cows were divided up into six groups according to the length of time elapsed between calving and time of service, and their average daily yield was estimated for 44 weeks: (see Table IV, on previous page).

It would seem that in no case has foetal growth reduced the yield (as compared with that shewn for the same period by groups where service has not occurred) sooner than 12 to 16 weeks after service. In the case of groups I, II, and V, it appears to have had no influence for 16 to 20 weeks. Since, then, 12 weeks at the very least (and probably 16 to 20 weeks) must elapse between service and any fall in yield due to foetal development, and since 97 per cent. of the cows were found to have reached their maximum day-yield within 16 weeks of calving and 99 per cent. in 20 weeks, the chances of the Revised Maximum being affected by time of service are seen to be very slight.

The table also shows that the milk yield diminishes generally in the absence of gestation and that the decrease due to this cause may be distinguished from that caused by foetal growth. The writer also points out that the rate of fall in both cases is very similar.

3. — This investigation was based on the records of 336 cows which had 5 or more calves. Lactations were measured as R. M. in quarts throughout. The mean R. M. and variation coefficients with the different calves were as follows:

			Variation coefficient
Mean	$R. M._1$	9.3 quarts	21.2
»	$R. M._2$	12.8 »	16.6
»	$R. M._3$	14.2 »	17.8
»	$R. M._4$	14.9 »	16.6
»	$R. M._5$	15.4 »	17.8

The coefficient of variation is 21.2 with the first calf, after which it falls to the neighbourhood of 17. Determinations made from a smaller number of cows revealed a tendency to rise again after the 5th calf. The increased variability of the 1st lactation yield seems more likely to be due to the greatly varying condition in which heifers are brought into the milking shed than to have any physiological basis. Differences in feeding and general treatment, and most of all in age, must influence very greatly the first lactation yield, and this influence must tend to decrease as the milking career advances. In considering the correlation between the first and subsequent lactation yields, it becomes necessary to decide on a figure to represent a cow's mature capability. For reasons analogous to those for which R. M. was selected as the figure to represent a lactation yield, the *maximum* R. M. was taken to represent a cow's mature capability, and the following correlation coefficients were obtained:

R. $M._1$	with	Max	R. M.	.394
R. $M._2$	»	»	»	.452
R. $M._3$	»	»	»	.506
R. $M._4$	»	»	»	.605
R. $M._5$	»	»	»	.762
Average of R. $M._1$ + R. $M._2$	»	»	»	.526
R. $M._1$		with	R. M_2	.437
R. $M._2$		»	R. $M._3$	.388
R. $M._3$		»	R. $M._4$	.576
R. $M._4$		»	R. $M._5$	.527

The correlation between R.M_1 and Max. R.M. is low, but can be substantially increased by taking the average of R.M_1 + R.M_2, and the fact that the relationship between all successive lactations is somewhat distant makes the correlation between R. M_1 and Max. R. M. more important than the value of .394 alone would indicate.

With regard to the estimation of mature from first-calf yield, a simple factor will not suffice, since cows starting badly tend to increase to a greater proportion of their first-calf yield than those which begin with a higher figure. Recourse must therefore be had to regression coefficients, which are given in the following table, together with the probable error of the estimate (Table V).

TABLE V.

Lactation	Regression Coefficient	Probable error of estimate
1st	$.57 \pm 0.050$	1.77 quarts
2rd	$.58 \pm 0.046$	1.66 »
3rd	$.60 \pm 0.037$	1.73 »
4th	$.73 \pm 0.035$	1.58 »
5th	$.82 \pm 0.026$	1.28 »
Average 1st + 2nd	$.79 \pm 0.053$	1.58 »

An example is given of the use of these coefficients, showing that if a cow gives R. $M_1 = 7.3$ quarts, which differs from the mean by—2, then her Max. R. M. will be = mean Max. R. M. — (2 × .57)

$$= 17.14 - 1.14$$
$$= 16 \text{ quarts.}$$

Further the chances are *even* that this estimate is correct within the limits of 1.8 quart. The inaccurracy is likely to be greater than this, since regression of R. M_1 has not yet been shewn to be linear.

Table VI is given for estimating the Max. R. M. from R. M_1, and from the average of R. M_1. and R. M_2..

TABLE VI.

R. M_1	Calculated Max. R. M.	Limits of probable error	Lactation total corresponding to Max. R. M.
qts.	qts.	± 1.7 qt.	gallons.
5	14.6		685
6	15.1		709
7	15.7		733
8	16.3		757
9	16.8		781
10	17.4		804
11	18.0		827
12	18.5		851
13	19.1		874
14	19.7		898
15	20.3		921
16	20.8		944
Average R. M_1 + R. M_2		± 1.6 qt.	
7	13.7		651
8	14.5		684
9	15.3		717
10	16.1		750
11	16.9		783
12	17.7		816
13	18.5		849
14	19.3		882
15	20.1		915
16	20.9		948

315 cows were also divided into three classes according to whether their R. M_1 was under 10 quarts, 10 to 12 quarts, or over 12 quarts, and their mean R. M. was calculated for subsequent lactations. (Table VII).

TABLE VII.

Class	No. of cows	Mean					Average of all lactations	
		R. M_1	R. M_2	R. M_3	R. M_4	R. M_5	R. M.	Correspon-ding lactation total
		qts.	qts.	qts.	qts.	qts.	qts.	gallons
C. 5–9 quarts.	153	8.1	11.3	13.7	14.4	15.4	12.6	604
B. 10–11 »	112	10.4	13.3	14.7	15.3	15.9	13.9	658
A. 12–17 »	50	13.0	14.9	16.1	16.4	16.9	15.5	724

Assuming milk to be worth 8*d* a gallon, an average cow of class A would give a return of £20 more than an average cow of class C. In practice it appears that cows of class C should be discarded after their first calf unless any extenuating circumstances are present, in which case a more reliable judgment can be formed of the cow's subsequent value by the mean R. M_1 + R. M_2. Cows of Class B will probably pay to keep, but will probably not turn out high yielders, while Class C will tend on the whole to maintain a good proportion, though not all, of their original start.

In conclusion, the writer points out with regard to the practical application of his results, that the definition of a cow's mature capability by means of her Max. R. M. implies many years' delay and reduces the available number of records by excluding all cows which did not reach maturity. Therefore it is advisable that a uniform system should be formed to deal with immature cows by calculating the Max. R. M. from the data available in each case. It is possible that calculation will give in many cases a less accurate result than a prognostication by a practical breeder, but in such work it seems essential that personal bias should be excluded.

47 – **Comparative Investigations into the Performance of the Breeds of Cattle kept in the Province of Saxony, Prussia.** — ERBINGHAUS, H. in *Deutsche Landwirtschaftliche Tierzucht*, Year 17, No. 40, pp. 473-476; No. 41, pp. 490-493. Hanover, October 3 and 10, 1913.

The writer avails himself of the results of five Milk Control Associations in the province of Saxony (Naumburg a. S., Mansfelder Gebirgskreis, Droyssig, Kayna and Witzenburg) in order to compare the cattle of the higher lands with those of the lowlands. The records of the five associations for 672 Simmental cows and 956 Lowland cows show the following results:

In the the Simmentals, the live-weight is 132 lbs. greater than in the Lowlands and the increase in weight 20 lbs. greater. With almost the same consumption of starch-values and the same number of milking days the Black-spotted cattle yield 504 lbs. more milk than the Simmentals, but as their milk contains 0.6 per cent. less fat they fall short of the Simmental in the production of butter-fat by 23 lbs.

The records of the Naumburg a. S. Association (all large farms) are as follows:

Breed	No. of cows	Live-weight	Milk yield	Fat content of milk
		lbs.	lbs.	per cent.
Simmental	44	1 316	5 722	4.17
Red-spotted Lowland.	117	1 247	6 653	3.17
Black-spotted Lowland.	245	1 214	6 844	3.34

The increase in live-weight was greatest relatively in the Red-spotted; actually this and the Simmental were equal, and 40 lbs. more than the Black-spotted. The Simmental is again first for butter yield, exceeding the Red-spotted and Black-spotted by 27 lbs. and 10 lbs. respectively. There are, however, no marked differences in general performance between the three breeds.

The cows under the control of the Mansfelder Gebirgskreis Association (large and medium farms) were 247 Simmentals, 450 Black-spotted Lowlands and 91 Harz. The result is that for the same ages and number of milking days the Black-spotteds yielded the greatest quantity of milk, both absolutely and relatively, but were run very close by the Simmentals. The Harz cattle yielded 739 lbs. of milk less than the Simmentals. The fat content (3.62 per cent.) and the quantity of fat (397 lbs.) were highest in the Simmentals, while Black-spotted Lowland and Harz cows showed nearly the same quantity of fat (214.5 and 209 lbs.). As regards the consumption of starch values the Black-spotted come first with 3963 lbs.; they are followed by the Simmentals with 3898 lbs., and the Harz with 3656 lbs. Simmentals and Black-spotted Lowlands are relatively and absolutely nearly alike, while the Harz cattle are somewhat inferior, notwithstanding the fact that relatively they exceed the Black-spotted animals in the yield of fat. Great differences, however, do not exist among these breeds.

A comparison of the performances of Simmental crosses (by Lowlands, local breeds, etc.) with pure Simmentals, from the data of three Associations, shows that the crosses give a greater increase of weight but a lower production of milk and fat.

Collecting the results of the investigations, it may be said that under the same economic conditions Simmental cattle possess the following advantages and disadvantages in comparison with the other breeds.

1. — The live-weight and increase of live-weight at the same age are greater than in the other breeds.

2. — The yearly yield of milk is lower than in the Black and Red-spotted Lowland cattle, but higher than in the Harz and cross-bred animals.

3. — The fat content and the quantity of fat produced are greater than in the other breeds.

4. — The consumption of fodder expressed in Kellner's starch-values is essentially the same as in the other breeds, the relative milk yield is lower, but the butter-fat yield and increase of live-weight are greater than in the other breeds.

48 - **The Freiburg Pied Mountain Cattle and their Employment for Crossing with the German Black-spotted Lowlands.** — MÜLLER, P. in *Jahrbuch für wissenschaftliche und praktische Tierzucht einschliesslich der Züchtungsbiologie*, Year 8, pp. 1-87. Hanover, 1913.

In his very comprehensive article, the writer gives a detailed account of the descent and history, as well as of the areas of distribution and breeding, of the Pied Mountain cattle native in the Freiburg Alps (Switzerland). The original home of this breed was in the north, whence it was presumably brought to Switzerland by the Celts many years before the Christian era. It is identical in origin with the Black-spotted Lowland breed, but received blood of other stocks (red Germanic cattle) at a very early period. Its colour alone distinguishes it from the Simmental, to which it is in no wise inferior as regards performance.

The number of Pied Mountain cattle in Switzerland was reckoned in 1911 at 38 196, of which 18 732 were in the Canton of Freiburg, and 6 000 in that of Berne (chiefly on the Jura). The Association of Swiss Pied Cattle Breeders ("Verband schweizerischer Schwarzfleckviehzüchter") in 1911 included 29 breeding societies (28 in the Canton of Freiburg and 1 in Neuenburg) with 45 bulls and 2574 cows.

The Pied Mountain cattle are exported to nearly all European countries, although only in small numbers, owing to their black colouring. Bulls for breeding purposes, when from six to nine months old, fetch £ 20 to £ 32 in the market in Bulle, while yearlings and two-year-olds make £ 32 to £ 100. The latest aims of the breeder are to obtain more even herds and animals with black heads and a white star (the Dutch markings) instead of with white heads. Of the total number of prize bulls in 1911 about 40 per cent. possessed the required black head. The writer gives the Floquet, Marquis-Max and Kapitän lines as those which produce the best bulls.

The milk yield is from 5500 to 13000 lbs.; the average weight of an adult cow from a good herd is 1430 to 1540 lbs., while that of a bull at three to five years may be as much as 2400 lbs. They kill at 58 to 65 per cent.

In the nineties of last century a considerable number of Pied Mountain cattle were brought into Germany, especially for the improvement of

the Black-spotted Lowlands. The first crosses usually proved very satisfactory, but further crossing tended to improve the fattening properties at the expense of the milk yield; this led to the Freiburg bulls being no longer employed. Further, attempts to breed Pied Freiburgs pure in Germany found little encouragement from the authorities. At the present day, Freiburg blood is still to be found in isolated Lowland herds in Thuringia, in Posen (sugar-beet farms) and in Kulmerland, West Prussia. The writer does not recommend this breed for crossing with the Black-spotted Lowland cattle, though he considers it adapted for special fattening purposes.

49 - **An American View on the Beef Cattle Situation. Present Status of the Industry.** — *Communicated to the International Institute of Agriculture by* W. J. KENNEDY, *Director of Agricultural Extension, Iowa State College.*

The solution of the beef cattle situation is one of the most important problems before our American people. This is something which concerns every man, woman and child in the United States. For the first time in the history of modern civilization our people are facing what appears to be a near beef famine. It has been gradually approaching us ever since 1907. The rapid increase in our population, thus a much heavier demand for beef, has caused high prices for all kinds of meat; thus many farmers have sold their breeding herds as well as the normal increase. The result has been a marked increase in demand and a very noticeable falling of in supply.

The World's cattle supply. — A shortage at home would not be so serious a matter from the consumers' standpoint, if there were an abundant supply in other countries. For some time the writer has been gathering data concerning the world's supply of cattle. It has been necessary to include all classes of cattle, because few countries outside of our own are able to furnish separate figures for beef and dairy cattle. Fairly reliable figures have been obtained concerning the increases or decreases in the number of both cattle and people in practically all of the leading meat producing and consuming countries of the world since 1900. These figures show conclusively that in all of the countrics, except Australia and France, the increase in cattle production has not kept pace with the increase in the number of people. A careful study of the same will clearly reveal the fact that there is a world-wide shortage of cattle and that the most alarming condition of affairs prevails in the United States.

The average increase in population is 19.9 per cent. and of cattle about 2.18 per cent.

Free meats from foreign countries. — A great deal has been said concerning the effect of putting meat on the free list. Some people have claimed that it would insure an abundance of good beef for the American people at moderate prices. Others have maintained that the putting of meat on the free list would drive the American farmer and ranchman out of the cattle raising business, on account of the low prices for meat and consequently of cattle on foot, which were sure to follow such legislation. A careful study of the world's cattle supply would indicate that both factions are almost sure to be disappointed. That there is a world-wide shortage of beef

Country	Population. Increase since 1900	Cattle Increase since 1900	Cattle Decrease since 1900
France	2 %	2 %	—
Germany	16 %	4 %	—
United Kingdom	10 %	4 %	—
Austria-Hungary	10 %	2 %	—
European Russia	14 %	—	12 %
Canada	35 %	20 %	—
Brazil	20 %	—	20 %
Argentina	40 %	—	6 %
Australia	18 %	40 %	—
New Zealand	30 %	16 %	—
United States	24 %	—	30 %

cannot be denied. This being true the placing of meats on the free list is not likely to reduce appreciably the prices of beef to the consumer or the prevailing prices for beef cattle. It is a well established fact that Europe is meat hungry and must look to Argentina and Australia for its supplies, and must thus bid against the United States or any other contender in the world's market. Even the most optimistic believers in free meat figure that at the very outside not more than 4000 head of cattle per week, or 2 000 000 lbs. of beef, can be expected. This amount would barely furnish enough beef for our annual increase in population. The very lowest estimates on our annual beef consumption place the amount at 56 lbs. per person, or for the whole population 14 400 000 lbs. per day; thus our people would eat the entire amount of articipated yearly importation of beef, some 100 000 000 lbs. in about seven days. This is a case where the law of supply and demand will be the controlling factor in the establishing of prices.

Conditions in the United States.—The beef cattle industry of the United States is in a most precarious condition. Between January 1907 and January 1913, the number of beef cattle in the United States decreased by 15 970 000 head, or about 32 per cent. During the same time our population increased about 10 000 000 people. Conditions are going to be worse in the next two or three years. A few weeks' study of any of the stockyards' markets will convince the most optimistic person that there are altogether too many cows, heifers and calves being rushed to market for the future good of the cattle business. It is a most pitiful sight, in the face of the present marked

shortage of cattle, to look over the daily receipts of our southern and western markets and find from 15 to 40 per cent. of the animals offered to be good young she stuff, just the kind that are needed for breeding purposes on the farms. This condition of affairs, if continued, can mean but one thing, namely fewer and fewer cattle in the years to come.

The Farmers' Duty. — It has been said that it is the farmers' duty to feed our people. This must necessarily include meat supplies, one of the most important of which is beef. If he is to fulfil his duty, he must get busy and raise more cattle. The present indications are that the future prices of beef cattle will be high enough to make the business a profitable occupation. Beef production must also be regarded as a factor in the conservation of the fertility of our soil. Soil conservationists claim that every time a bushel of corn is sold off the farm about 16 cents worth of fertility is removed. If corn be fed through beef cattle, but 5 cents worth of fertility is removed. About the same ratio prevails for the other grain and forage crops of the farm. These are factors worthy of careful consideration. There is no more important problem before our American people than the maintaining and building up of the fertility of our soil. Considering the labor involved, no line of farming is better adapted to soil-building than beef production.

Factors necessary to insure successful production of beef in the Corn Belt of America. — 1. — We must put more of our land under blue grass pasture. Many Iowa farmers are getting from $10 to $15 per acre from the blue grass pastures through the utilization of the same for beef production and cattle feeding purposes. This is an excellent way to help solve the labor problem on the farm, as beef cattle require but very little labor during the grazing season.

2.— The farmers of Iowa annually leave from five to seven million acres of corn stalks in the fields, thus very largely wasted. This is a wasteful method of farming, something unknown in the more densely populated countries where land is on a par with or higher in value than our own. A large amount of this waste could be, and will be, eliminated through the use of the silo, and then we shall be able to winter economically more beef cows and young stock on our farms.

3. — There should be some alfalfa grown on every Iowa farm. This is the heaviest yielding, most drought resisting, most palatable and most nutritious crop that can be grown on our farms. No other crop is so valuable in the growing and finishing of baby beef.

4. — The wise farmer will retain his heifer calves and cows for breeding purposes. Future prices for beef cattle should be as high as or higher than those of the present time ; thus it is a short-sighted policy which leads a man to dispose of his breeding stock. This is a time when men should increase, not reduce their breeding herds.

5. — A man to be successful in any line of work must stay by the job. The fellow who is always changing never makes much progress. This is especially true of the beef business. No man can anticipate the high mar-

kets or the low ones, but the man who is always in the business is sure to reap profits when the other fellow is short, that is when the demand is greater than the supply.

50 - **On the Relation between the Fat Content and Natatory Powers of Fish.** — POLIMANTI, OSW. in *Biochemische Zeitschrift*, Vol. 56, Part 5-6, pp. 439-445. Berlin November 5, 1913. FISH

The writer tried to ascertain by means of chemical analysis whether a difference exists in the water and fat content of marine fish of the nekton and benthos which whould account (independently of the swim-bladder) for the different swimming capacity of these two groups. It is shown by the data given in the tables, that the water content of the fish of the nekton is somewhat less than that of those of the benthos, while the fat content of the former is about three times greater than that of the latter. Further, within each of these groups differences can be shown to exist in the water and fat content; the less active the species, the more water and the less fat it contains, and *vice versa*. From this, the writer concludes that a correlation exists between the natatory powers and the specific gravity, or fat content, and considers that the fish of the nekton owe their greater swimming capacity not only to their larger swim-bladder, but also to their higher fat content.

51 - **Fur-Farming in Canada.** — *A Report to the Commission of Conservation*, JONES J. W., pp. 159, Ottawa, 1913. OTHER LIVE STOCK.

This report is a manual of fur-farming, giving an account of the history and present extent of the industry, as well as practical details of the ranches on which the different kinds of animals are kept. The preparation of skins for manufacture and the commerce of raw furs are also dealt with.

FARM ENGINEERING.

52 - **Experiments with Meyenburg's Motor Cultivator** (1). — BRETIGNIÈRE, L. in *Journal d'Agriculture Pratique*, Year 77, No. 44, pp. 557-559. Paris, October 30, 1913. AGRICULTURAL MACHINERY AND IMPLEMENTS.

In order to investigate the difference between the work of the plough and of the motor cultivator and its effect upon the crops, parallel experiments with wheat and oats were conducted in the autumn of 1912 at the Agricultural College of Grignon. Both cereals were sown on some plots that had been ploughed and on others that had been worked with the motor cultivator.

The writer gives a short description of the machine and then passes on to the experiments. The wheat was sown after potatoes and at the rate of 178 lbs. per acre, and yielded, per acre, as follows:

(1) See No. 972, *B.* Aug. 1913. (*Ed*).

	Weight of sheaves	Straw	Grain	Chaff
	lbs.	lbs.	lbs.	lbs.
On ploughed land	8 474	* 5 263 (62.1)	2 373 (28.0)	838 (9.9)
On land worked by motor cultivator	8 082	4 888 (60.5)	2 489 (30.7)	705 (8.8)

* The figures in brackets in this and the following tables refer to the percentage of straw, grain and chaff.

On another plot, after carrots for feeding, wheat was sown at the rate of 107 lbs. per acre ; the results were the following :

	Weight of sheaves	Straw	Grain	Chaff
	lbs.	lbs.	lbs.	lbs.
On ploughed land	9 143	5 575 (61.0)	2 877 (31.5)	691 (7.5)
On land worked by motor cultivator	9 143	5 932 (64.9)	2 498 (27.3)	714 (7.8)

The total average per acre was thus :

On ploughed land . . . . 5 419 lbs. straw and 2 624 lbs. grain
On land worked by motor cultivator . 5 410 » » » 2 493 » »

The difference is too small to justify any conclusion being drawn in favour of the plough.

The second part of the paper deals with experiments made with oats. In experiment I the crop was harvested on August 7, in II in August 8 ; both were threshed soon after.

The results were:

		Weight of sheaves	Straw	Grain	Chaff
		lbs.	lbs.	lbs.	lbs.
I	On ploughed land . . .	6 601	3 960 (60.0)	1 927 (29.2)	714 (10.8)
	On land worked by motor cultivator	4 460	2 462 (52.2)	1 195 (26.8)	803 (18.0)
II	On ploughed land . . .	5 855	3 690 (63.0)	1 952 (33.3)	213 (3.7)
	On land worked by motor cultivator	4 086	2 531 (61.9)	1.372 (33.6)	184 (4.5)

In the experiment with oats the difference in favour of the work accomplished by the plough is more marked.

53 – **Motor Plough Trials of the German Agricultural Society at Klein-Wanzleben.** — LICHTENBERGER in *Deutsche Landwirtschaftliche Presse*, Year 40, No. 86, pp. 1027-1029. Berlin, October 25, 1913.

The trials of motor ploughs organized by the German Agricultural Society (" Deutsche Landwirtschafts-Gesellschaft ") extended over a period of nearly two months and consisted of a preliminary trial which lasted seven days' of the trial itself during three days, and of a thirty days' trial of resistance, followed by an eight days' brake test.

Nine outfits were presented; one of them, Kuers' plough (of Tegel near Berlin), belonged to the double-engine system; five were tractors hauling the tillage implements attached to them, and the three last were motor ploughs in which the machine and the plough are in one body.

TABLE I.

Plough	Date	Work per hour	Depth of work	Fuel consumed per acre	Cost of fuel per acre	Fuel used
	Aug.	acres	inches	lbs.	s d	
Kuers	21.	1.047	10.6	17.53	1–7	Crude benzol
»	22.	1.040	7.5	14.99	1–5	»
I. H. C.	21.	1.784	10.6	27.84	3–2	Citin
»	22.	1.935	7.5	21.86	2–6	»
Universal.	21.	0.800	10.6	—	—	Benzol
»	22.	1.278	8.9	22.84	2–11	»
Caterpillar	21.	1.685	11.0	26.41	4–5	Benzine
»	22.	2.180	7.9	18.29	3–0	»
Pöhl (large)	22.	0.988	8.3	33.36	4–3	Benzol
Pöhl (small)	21.	0.680	10.6	34.17	4–4	Benzol
»	22.	0.741	9.1	26.50	3–5	»
Akra.	21.	1.354	11.2	23.73	3–0	Benzol
»	22.	1.621	8.7	18.29	2–3	»
Stock	21.	1.606	12.0	24.80	3–1	Benzol
»	22.	1.525	7.5	19.18	2–5	»
W. D.	21.	1.290	10.4	21.28	2–9	Benzol
»	22.	1.389	8.1	19.36	2–6	»

The writer gives some data on the ploughs and reports upon the various trials. In the trial itself all the outfits worked in the same field under conditions as similar as possible and under continuous individual control. Account was kept of the consumption of fuel, lubricants and water, of the area and depth of the work done, etc. Further, the quality of the work and the manner of working were also considered. The results of the two first days of the trial itself are given in Table I.

On the third day of the trial all the machines were submitted to dynamometer tests both when running empty and with a full load; the dynamometers used were self-registering instruments with glycerine filling and mounted on wheels.

The following table contains the data obtained during the thirty days' resistance test:

TABLE II.

Plough	Number of days during which		Area ploughed			
			Depth			
	the plough could work	the plough did work	less than 7 ½ inches	7 ½ to 10 ¼ inches	more than 10 ¼ inches	Total
			acres	acres	acres	acres
Kuers	33	31	81.5	—	228.8	310.3
I. H. C.	33	32	73.8	202.4	154.7	430.9
Universal	35	26	156.5	—	86.8	243.3
Caterpillar	33	33	133.5	46.5	314.3	494.3
Pöhl (small)	—	—	60.1	8.7	—	68.8
Akra	33	25	—	330.8	—	330.8
Stock	35	34	194.7	—	117.8	312.5
W. D.	32	31 ½	83.3	152.3	54.2	289.8

54 – **Maillet's Motor Tilling Machine.** — *Le Génie Rural*, Year 5, No. 47-48, pp. 5-6. Paris, June-July 1913.

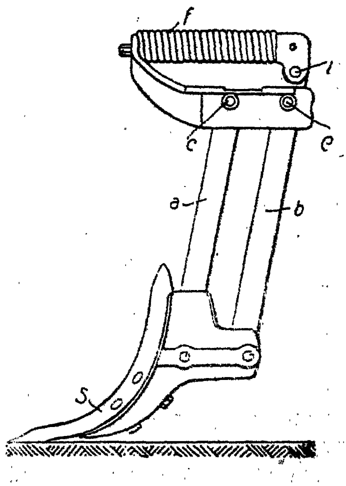
This is a description with illustration of a motor tilling machine which is characterized by the tilling implement being screw-shaped. A small motor causes the screw to revolve. The surface of the screw turns a furrow slice over like a mouldboard would do. The diameter and the pitch of the screw depend upon the kind of work in hand. The depth of the work can be adjusted. The steering is accomplished by means of two handles fixed at the back of the machine, which is mounted on two wheels, and has been designed for use in vineyards.

55 - **Trial of a "Universal" Spring-Tooth Cultivator.** (8th Report of the Station for the Testing of Agricultural Machines and Implements at Hanover). — NACHTWEH, A. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs- Anstalten*, Year 7, Part 3, pp. 89-92. Berlin, 1913.

This " Universal " cultivator was handed over in the spring of 1910 to the Station for testing agricultural machines and implements at Hanover for trial. It was sent to the Gleidinger estate near Hanover and regularly used in the farming operations of the estate in spring and autumn.

The writer gives a detailed description of the implement, in which the device for regulating the depth of work is new. It consists of an endless screw with crank handle mounted on a support fixed at right angles to the axle of the rear wheels. A further novelty is an angle lever, which forms an adjustable connection between the intermediate frame and the pivoting fore-carriage, by means of which, and by turning the above-mentioned crank handle, the implement can be adjusted simultaneously in front and behind to the required depth, even while working in heavy ground and without stopping the team.

Another new feature is the build and arrangement of the teeth, which are patented in Germany (No. 223 716). One of them is shown in the adjoining figure



It consists of two parallel iron bars, *a*, *b*, fastened to specially formed cross pieces, *c*. The rear bar, *b*, is prolonged above the cross piece and connected by a bolt, *i*, with a strong rod bearing round it a spiral spring, *f*, which takes up and deadens the shocks that the tooth *S* encounters while working.

The writer gives, in the form of a table, the measures and the prices of the different sizes in which the cultivator is built, and also the number of draught animals required for each.

The conclusion drawn from a long-continued test is that this cultivator is a practical implement, suitably constructed for its work, which it performs in a satisfactory manner.

56 – **Spring-Tooth Harrows.** — RINGELMANN, M. in *Journal d'Agriculture Pratique*, Year 77, No. 39, pp. 408-410. Paris, September 25, 1913.

The writer begins by the following results of observations made with three rigid harrows with vertical teeth:

	Harrows A	Harrows B	Harrows C
Effective breadth of tooth.	0.71 in.	0.82 in.	0.98 in.
Average distance between the teeth measured at right angles to the direction of draught	1.69 in.	2.36 in.	1.77 in.
Average weight of each tooth. . . .	4.4 lbs.	4.2 lbs.	4.6 lbs.
Depth of work done	1 3/4 in.	2 in.	2 in.
Average traction power per tooth. . . .	4.84 lbs.	9.02 lbs.	11.44 lbs.
Average traction power per tooth and inch of depth	2.8 lbs.	4.5 lbs.	5.6 lbs.

He then gives the data obtained by experiments made with three spring-tooth harrows on the same day and in the same field as the three preceding harrows:

	Harrows E	Harrows F	Harrows G
Effective breadth of teeth.	2.17 in.	2.17 in.	1.89 in.
Average distance between the teeth measured at right angles to the direction of draught	3.94 in.	3.94 in.	4.09 in.
Average weight per tooth	15.6 lbs.	15.6 lbs.	17.6 lbs.
Depth of work done	2 3/4 in.	3 1/4 in.	3 1/2 in.
Average traction power per tooth. . . .	69.3 lbs.	85.8 lbs.	44.6 lbs.
Average traction power per tooth and inch of depth	25.2 lbs.	27.4 lbs.	12.9 lbs.

From the above results the writer concludes that with an average of 1.2 inch breadth of tooth and a distance of 2.4 inches between the tines, a greater depth of work can be attained with spring-tooth harrows without increase of traction power.

57 – **Threshing with Steam Engine or with Electric Motor.** — TIETZ, P. in *Deutsche Landwirtschaftliche Presse*, Year 40, Nos. 82 and 83, pp. 979-981 and 995-997. Berlin, October 11 and 15, 1913.

In order to obtain reliable data on the economic difference between these two systems of producing power, the Magdeburg Steam Boiler Association ("Magdeburger Verein für Dampfkesselbetrieb") carried out in February and March 1913 extensive comparative experiments in two farms. The

writer gives data on the machines used, on the loss of grain, on the consumption of fuel, etc.

In the second part of the paper the general pros and cons of the two power systems are discussed, and with the aid of two tables the costs of electric and steam threshing are compared. These experiments show that the alleged superiority of electric threshing as to cleaner and cheaper work does not correspond to reality.

58 - **Trial of a Roller Mill.** (41st Report of the Machine Testing Station of the Chamber of Agriculture for the Province of Brandenburg). — FISCHER, G. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen Prüfungs-Anstalten*, Year 7, Part 4, pp. 153-161. Berlin, 1913.

The machine was submitted to a series of tests on April 23 at the Agri cultural College in Berlin and then entrusted to the Hobrechtsfeld farm in the neighbourhood of Berlin and belonging to it, for the trial of resistance.

The writer gives a detailed description of the machine and of its working.

A cast iron support bears the hopper and the feeding device (see fig. 1). The milling rollers are enclosed in a cast iron case resting on a strong frame. Fig. 2 shows a section through the mill.

Its price is about £42 10 s.

A report of the trial is given and the data obtained are grouped in the following table.

No. of trial	Date	Grain ground	Duration of trial		Performance	Power required	Number of revolutions per minute	Degree of fineness of product	Kind of groats	Performance per hour	Performance per HP.-hour
			Min.	Secs.	lbs.			> 3 : > 2 : > 1 : < 1 mm.		lbs.	lbs.
1	23.4.13	Barley	4	56	202	10.87	408	3:8:68:21	medium	2462	227
2	»	»	2	25	173	10.50	423	8:25:54:13	»	4290	409
3	»	Maize	5	11	389	11.35	411	—	—	4497	396
4	»	Rye	1	50	183	11.52	417	4:44.5:37.5:14	coarse	5997	521
5	23.6.13	»	49	40	4565	11.00	419	19.5:39.5:29.5:11.5	»	5386	491
6	»	Barley	46	30	3496	11.75	415	15:32:40:13	medium	4510	385
7	»	»	2	50	117	10.90	416	4.5:7.5:36:52	fine	2468	226
8	20.9.13	Rye	50	30	5392	13.05	420	11.5:41.5:34.5:12.5	coarse	6406	493
9	»	Barley	30	00	2424	11.70	420	20:34:35:11	medium	4849	414
10	»	Maize	9	00	1485	8.85	421	75:15:7.5:2.5	crushed	9900	1118
11	»	»	4	35	234	12.35	419	0.5:9:61.5:29	medium	3067	249

The final judgment on the mill was as follows: It is simple and suitably constructed in all its parts, and is easy and safe to handle. The output is considerable and the amount of power it requires, considering the output and its degree of fineness, is very low. The mill is suitable for the

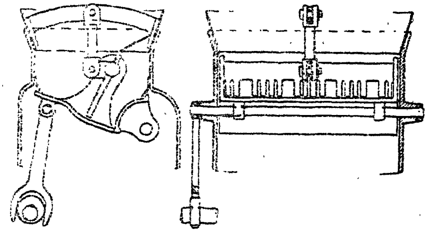


Fig. 1. — Hopper and feeding device.

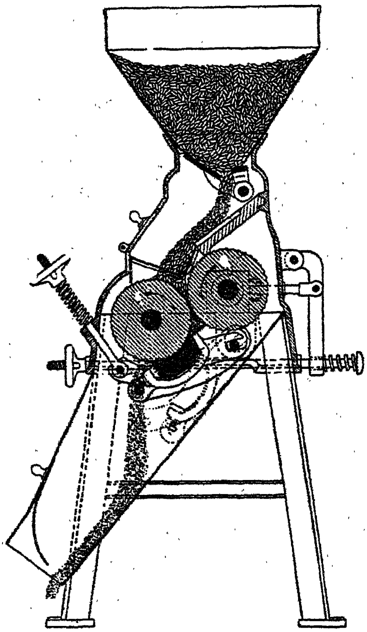


Fig. 2. — Section of roller-mill.

production of groats of the degree of fineness most required in practice, and the product is good and cool. The feeding device and the case round the rollers are remarkable and practically important innovations in the construction of agricultural mills. The durability of the mill, according to the trial of resistance, is great.

59 – Review of Patents.

Tillage implements and machines.

266 626 (Germany). Turn-wrest plough with shares that can turn round the beam.
266 627 (Germany). Motor tilling machine with hydraulic lifter for the tilling implements.
266 752 (Germany). Motor power plough with driving wheels driven by differential gear, and fitted with special steering wheel.
62 531 (Austria). Motor plough consisting of hauling motor and plough chariot.
62 584 (Austria). Portable cultivator with implement shaft driven by motor and placed behind the driving wheels.
62 852 (Austria). Motor plough.
59 897 (Hungary). Soil tilling machine with implements mounted on a drum.
59 804 (Hungary). Turn-wrest plough.
60 182 (Hungary). Motor plough.
255 592 (Belgium). Motor plough.
254 232 (Belgium). Turn-wrest plough.
254 832 (Belgium). Traction engine for ploughs and other agricultural implements.
1 076 752 (United States). Plough.
1 075 410 (United States). Disk-cultivator.
1 076 520 (United States). Combined plough and harrow.
459 039 (France). Machine for tilling the soil.
459 302 (France). Improvement in ploughs driven by motor.
459 211 (France). Harrow with rotating teeth.
303 (United Kingdom). Motor-driven cultivator.
20 524 (United Kingdom). Plough.
3 966 (United Kingdom). Oscillating plough.
135 282 (Italy). Improvements in soil tilling implements hauled by cables.
134 816 (Italy). Ploughing machine.

RURAL ECONOMICS.

60 – Some Profitable and Unprofitable Farms in New Hampshire. — ROBERTSON, FRED. E. and DODGE, LAWRENCE G. in *U. S. Department of Agriculture, Bureau of Plant Industry, Circular* No. 123, pp. 3-15. Washington, May 24, 1913. RURAL ECONOMICS.

The New Hampshire College Agricultural Experiment Station, together with the Bureau of Plant Industry, U. S. Department of Agriculture, investigated the working and profitableness of 428 farms in the State of New Hampshire. The results of these investigations are given and discussed by the writers in this paper. They compare the averages of the group of 100 profitable farms with those of 100 of the least profitable ones, and from the comparison draw conclusions as to the causes of the great difference in economic success, as is shown by the following table:

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Receipts	2 318	991	1 439
Expenses	1 083	792	796
Net income	1 235	139	643
Interest on investment, 5 %	360	348	308
Family labour	53	130	70
Labour income	830	—341	266

The average areas of all the 428 farms of which data were obtained are the following:

	100 better farms	100 poorer farms	Average: 428 farms
	acres	acres	acres
Tillable	50	44	43.2
Pasture	130	100	99.8
Woodland	23	29	30.5
Total	203	182	173.5

The difference in acreage is slight; the group of better farms has an average of only 21 acres more land per farm than the poorer group and only 6 acres more of tillable land. When it is considered that the labour income of the farmers on the better farms averages $830 and that those farmers on the poorer farms have a minus labour income averaging $341, the small difference in acreage does not seem to offer an adequate explanation for the great difference in income.

When these same 200 farms are redivided on the basis of tillable acreage, the 100 having the largest tillable acreage have an average labour income of $341, while the 100 with the smallest tillable acreage have an average of $190. This would indicate that acreage is certainly one factor that counts in determining the labour income, though not enough to explain the above-mentioned great difference.

The writers then compare the distribution of capital in the two groups:

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Machinery and tools	453	351	352
Real estate	4 864	5 332	4 404
Live stock	1 592	1 045	1 152
Grain and feed	145	106	106
Cash to run business	163	144	137
Total	7 217	6 978	6 151

The difference of $239 per farm is so small as to offer no reason for any great difference of earning power between the two groups.

A marked difference exists, however, between the two groups in the distribution of the capital. The better farms have 32.6 per cent. of their total capital as working capital and the poorer have only 23.5 per cent. as such. This unfavourable condition is often due to having relatively too much capital in buildings.

The receipts from the better farms exceed those of the poorer by 149 per cent., as is shown by the following table:

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Crop sales	347	136	262
Net live stock sales	260	121	162
Sale of stock products	1 389	612	814
Increased inventory	184	30	110
Outside labour	138	32	91
Total receipts	2 318	931	1 439

The greater success of the farmers belonging to the first group is not caused by an absolute saving of expenses, because their average expenses

are $291 or 36.7 per cent. greater than on the poorer farms, as the following table shows:

	100 better farms	100 poorer farms	Average: 428 farms
	$	$	$
Hire of labour	250	181	173
Board of labour	76	74	59
Seeds	21	14	15
Fertilizers	64	37	40
Hay	17	11	15
Feed and grains	398	258	284
Machinery	45	22	28
Buildings and repairs	46	40	40
Silo filling	11	6	8
Horse-shoeing	24	20	20
Milk hauling	11	11	8
Taxes	73	78	66
Other expenses	38	40	40
Total	1 083	792	796

The success of the better farmers is due to more and better crops and more productive herds, which in their turn are due to a more efficient use of land and time.

The writers also give tables comparing the conditions and incomes of two characteristic farms of the first group and one of the second, which lead to the same conclusions.

61 – **The Private Economic Conditions of Moravian Peasant Farmers.** — Communication of the Book-keeping and Farming Department of the German Section of the Moravian Agricultural Council, in *Zentralblatt für Landwirtschaft*, Year 93, No. 22, pp. 253-255. Brünn, November 16, 1913.

The data obtained from 79 Moravian peasant farms show that, without considering debts or other burthens, the average income per acre is £2 15*s* 8*d*, of which £2 7*s* 7*d* (85.4 per cent.) is derived from the farm itself, 2*s* (3.7 per cent.) from accessory industries, and 6*s* 1*d* (10.9 per cent.) from other sources. The average extent of the farms being 73.66 acres, the average yearly income of the 79 farms is the following:

Income of Debt-free Properties.

	Group	Average extent of farm: acres	Altogether: from farm itself	Altogether: from accessory industries	Altogether: from other sources	Altogether: Total	Per acre: from farm itself	Per acre: from accessory industries	Per acre: from other sources	Per acre: Total	In percentages: from farm itself	In percentages: from accessory industries	In percentages: from other sources	In percentages: Total
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.	£ s. d.				
Influence of natural conditions	I	71.79	221 11 1	13 6 9	70 7 10	305 5 8	3 1 9	3 8	18 3	4 3 8	73.8	4.4	21.8	100
	II	75.57	164 8 4	3 5 10	15 5 11	183 0 1	2 3 6	1 0	4 0	2 8 6	89.5	2.0	8.5	100
	III	70.06	164 4 2	13 0 1	7 1 8	184 5 11	2 6 11	3 8	2 0	2 12 7	89.2	7.0	3.8	100
Influence of economic conditions	I	48.80	84 15 5	12 6 9	6 11 9	103 13 11	1 14 9	5 1	2 8	2 2 6	81.7	11.9	6.4	100
	II	81.27	163 2 6	16 9 3	13 0 11	192 12 8	2 0 2	4 0	2 8	2 6 10	85.7	8.6	5.7	100
	III	58.44	158 14 2	1 19 2	25 12 6	186 5 10	2 14 4	0 8	8 9	3 3 9	85.1	1.1	13.8	100
	IV	96.45	172 5 0	3 5 0	17 17 7	193 7 7	2 13 8	0 8	3 8	2 18 0	92.4	1.1	6.5	100
Influence of extent of farm	I	223.88	336 0 10	3 15 10	15 1 9	354 18 5	1 10 0	0 4	1 4	1 11 8	94.6	1.0	4.4	100
	II	108.11	240 13 8	14 11 9	25 11 0	280 16 5	2 4 6	2 8	4 9	2 11 11	85.7	5.1	9.2	100
	III	69.76	139 19 10	1 3 4	20 0 1	161 3 3	2 0 2	0 4	5 9	2 6 3	86.8	0.7	12.5	100
	IV	49.05	154 14 1	6 12 6	26 9 4	187 15 11	3 3 1	2 8	10 9	3 16 6	82.3	3.5	14.2	100
	V	25.49	56 7 9	4 15 10	5 5 0	66 8 7	2 3 6	3 8	4 0	2 11 2	84.8	7.2	18.0	100

	£	s	d
Income from the farm itself	175	3	6
Income from accessory industries	7	9	1
Income from other sources	22	7	3
Total	204	19	10

The amount of the income from the farm itself diminishes as the natural and economic situations become less favourable, as well as with a decrease of acreage. The proportion of the income of the farm itself to the total income becomes greater the more unfavourable the natural position of the farm and the more favourable its economic situation; it becomes smaller the smaller the farm, for as the latter does not afford the owner sufficient income, he is obliged to have recourse to other sources to eke out his means of living. It appears however from the annexed table: "Incomes of debt-free properties," that the principal occupation of the owners of all the farms examined is agricultural, for in all the groups the income from the farming proper is by far the largest item of the total income, so that all the other sources of revenue are to be considered as auxiliary.

The average net income from the farm (£2 *7s 7d* per acre) bears, on the average of the 79 farms, a burthen of 6*s* 1*d* (12.7 per cent.) interest on debts and 4*s* 0½*d* (8.5 per cent.) servitudes in kind, together 10*s* 1 ½*d* (or 21.2 per cent.). Only 16 out of the 79 farms (or 20.2 per cent.) are free from debts and only 39 (or 49.3 per cent.) are free from servitudes in kind.

The amount of the debts is not influenced by the natural and economic conditions of production, though on going from the plains towards the mountains a decrease of the amount of servitudes is noticeable. The same is observed with the improvement of economic situation.

The average net income of £2 *7s 7d*, together with £3 *2s 6d* a month as remuneration for the farmer's labour, works out at an interest of 1.89 per cent. on the capital. The average indebtedness of the 79 farms amounts to £6.9*s* 2*d* per acre (on a land value of £34 4*s* 1*d* per acre). The interest on the farming debts is about 4.7 per cent; compared with the interest on the capital, namely 1.89 per cent., this is a high rate of interest and diminishes the farmer's share of the net profit to a a considerable extent. From the calculation of averages it appears that the rate of interest (1.89 per cent.) on debt-free farms is reduced to 1.33 per cent. by the servitudes, to 1.27 per cent. by debts and to 0.5 per cent. by both together.

62 - **Farming Conditions in the Department of Puy-de-Dôme, France.** — AUGÉ-LARIBÉ, MICHEL in *La Vie agricole et rurale*, Year 4, No. 46, pp. 497-501. Paris, October 1913.

Division of the country into agricultural belts according to altitude above sea-level; acreage devoted to the principal crops; characteristic of the agriculture of the regions in the extension of forage crops: with less than 495 000 acres under cereals there are upwards of 741 000 acres of forage crops. The increase of acreage and of yield per unit of area of the most exacting cereals (wheat, oats and barley) are evidence of progress in farming

since 1892. From that year to 1911 the area under vineyards sank from 109 274 to 57 601 acres, whilst the area devoted to field forage-plants rose from 135 910 acres to 148 265, and that under meadows and pastures from 452 210 acres to 625 180. Fruit-growing and market gardening are steadily extending.

The number of horses rose from 15 500 in 1892 to 18 500 in 1911, that of mules from 499 to 830 and that of asses from 3805 to 6300, while the number of sheep fell by about 100 000 head. The breeding of cattle has developed greatly. In the mountains dairying (butter and cheese making) prevails, while on the plateaus and in the valleys cattle are more used as draught animals, the cows also being harnessed.

The subdivision of land has been carried far and represents one of the greatest obstacles to the further introduction of improved methods of farming: small farms (under 25 acres) are prevalent and the fields composing them are frequently at a distance from each other. The land is mostly farmed by the owners themselves; it is seldom rented and only exceptionally worked on the share system. Only by a greater development of cooperation and by untiring agricultural education in the country will farming be able to make further progress under existing conditions.

63 – **The Profitableness of Milk Farms.** (1). — AUF DEM THIE, HERMANN in *Archiv für exakte Wirtschaftsforschung*, Supplement 11, pp. 1-99. Jena, 1911.

The author seeks to establish the individual factors of the profits made by milk farms under various conditions, availing himself of the data obtained by book-keeping, partly taken directly, partly from the literature on the subject. After some preliminary observations on the conflicting opinions found in the above literature on the profitableness and the importance to public economy of this system of keeping milch cattle, the writer discusses the methods for ascertaining the profitableness of a branch of farming in general, and of keeping milch-cattle in particular, the calculation of the cost of milk production, and the determination of the utilization of the forage used. He then investigates, with the aid of tables, which contain the individual results of his calculations, the effect of the several factors upon the profits of milk farms.

The fodder consumed by individual animals and by various herds is utilized by them very variously as regards both the production of milk and the increase of live weight; as the better performance, in so far as it depends upon the nature of the animals, is, under certain conditions, available free of expense, the increase in the capacity of producing is an important factor of profit; on the other hand, the high price that is paid for highly productive animals often counterbalances the advantages of a good utilization of fodder.

The loss on selling cows may be distributed over a longer period by feeding to keep up the milk yield when the cow would naturally be drying off;

(1) German « Abmelkbetrieb », *i. e.* when the cows are bought in, milked once, and sold off again. *(Ed).*

but if the cost of the extra concentrated food exceeds the value of the extra milk obtained, the utilization value of the home-grown produce will be reduced, and to an extent varying with the proportion of purchased food fed and the difference between its price and utilization value. When the purchase price is above the utilization value, the number of cows must depend on the amount of forage produced on the farm. If, however, the utilization value is greater than the purchase price, milk production may profitably become a purely industrial undertaking depending entirely on purchased food.

The amount of the milk yield in exclusive milk farms has not generally the decisive influence upon the profitableness that it has in other dairy farms. With the yield of milk, expenses increase also, especially those for concentrated foods, while the cost of labour and general expenses are not influenced to any great extent. Increased expenditure with the object of attaining a high milk yield is all the more justified the higher the price of milk, because the great influence which this has on the profits of the milk farm is felt increasingly with augmenting milk yield. The profit realized upon the milk depends upon the economic position of the farm, and the consequent manner of utilizing the milk. The best utilization of milk is by direct disposal to private customers; no doubt the expenses entailed by selling the milk in this way are often high enough, but they do not reach the trade profit of the milk merchant and the expenses of the dairies that collect milk from the producers. Selling the milk to dairies that make butter, and working up the milk in the farm itself, are in general the least profitable ways of utilizing milk.

The general expenses and those for labour and teams make up a great part of the total outlay and weigh all the heavier the lower the price of the milk and the lower the milk yield, as they do not depend upon these factors.

The average cost of labour per cow per annum is about £3, the general expenses about £1 10s, while the expenses for team work, which are lower, vary considerably according to the economic position of the farm. Of special importance for the profitableness of the keeping of milch cows is the work of the stable hands. By improper feeding, bad milking and careless treatment, many losses may be incurred. The wages must be so arranged that the profits of the attendants coincide with the interest of their employers (rewards on a sliding scale).

The difference between the buying-in price and selling-off price of the cows has also a great influence on the profit of milk farms. It determines the extent and the character of the milk farm. If the buying-in price of the unit of weight is lower than the selling-off price, the quickest turning over of the capital in cows is, from the point of view of private economy, the most profitable. But there are few farms which realize such a profit on the animals; most farms must put up with a loss of live-weight, which is frequently considerable. In one of the farms examined, this loss amounted to £8 6s per cow per annum. As a consequence, the present tendency is towards keeping the cows longer and allowing the best to calve again in the

farm (Halbabmelkbetrieb). By their staying longer, the loss in live-weight is spread over a longer period and partly balanced by the sale of the calves. The feeding, also, is less intensive in these farms, many of the more expensive foods being saved. The consequent diminution of expenses is not, in most cases, set off by a smaller quantity of milk being sold. In this system, also, the injury caused by the exclusive milk-farms to public economy, by selling milch-cows prematurely to the butcher, is not so great, and frequently the best calves get sold to breeders instead of to the butchers.

The question whether exclusive milk-farming is economically the best way of keeping milch-cows, and how the farms are to be arranged and managed in order to yield the greatest profit, cannot be answered without careful examination of all the factors contributing to the net profit, generalizations of only a few figures being often misleading.

AGRICULTURAL INDUSTRIES.

64 — **Summary of the Results of Researches made during the Last Few Years at the Dairy Institute at Alnarp (Sweden), by L. F. Rosengren.** — *Communication by the Official Correspondent of Sweden to the International Institute of Agriculture.* DAIRYING.

I. *Fat content of skimmed whey.*—If whey is submitted to a violent motion, such as, for instance, working in a churn for 30 minutes at a temperature of 50° C. (122° F.), the cream cannot afterwards be separated to the same degree as if it had not been so treated. Thus the writer found that whey containing 0.305 per cent. of fat was reduced by separating without previous churning to a fat content of 0.035 per cent., whilst when churned before separating it was reduced to only 0.235 per cent. This result agrees with that obtained in M. Barthel's experiments on separating (*Revue générale du lait, III*, p. 25).

Whilst the determination of the fat content according to Röse-Gottlieb's method gives higher results than when Adams' method is followed, the difference becomes still greater if the milk has been worked before skimming. M. Barthel has shown that this difference does not appear on examining the whey. This fact confirms the hypothesis of M. Weibull that in drying the milk according to Adamas' method, the smallest globules of fat are enclosed in the casein, so that they are inaccessible to dissolution in ether (*Laudtbruksakademiens Handlingar och Tidskrift*, 1898, p. 3).

This higher fat content obtained by Röse-Gottlieb's method, cannot, on the other hand, result from the dissolution of gelatinous membranes in the ether and benzine mixture, as M. Storh supposed (36 *Beretning frå K. Vet. og Lundbohöisk. Lab. f. Landoekön. Forsog*, 1897, p. 87), since the quantity of matter not fat dissolved by the above mixture is too insignificant to be able to exert any notable influence on the results of the analysis, and besides it does not consist of gelatinous membranes, but of lecithin or of products of its decomposition. (ROSENGREN, L. F. « Gottlieb ou Adams » in *Revue gènérale du lait* III, 1904).

2. *The fat content of skimmed milk in connection with the progress of lactation.* — The writer has demonstrated that there is a considerable difference in the degree to which milk is capable of separation at the different periods of lactation. Accordingly as the milk came from cows near the end of the lactation or from cows that had recently calved or was a mixture of these two kinds of milk, it contained the following amounts of fat:

Temperature of separating	Milk of cows drying off	Milk of cows recently calved	Mixed milk
—	per cent.	per cent.	per cent.
30° C (86° F.)	0.235	0.12	0.18
40° C (104° F.)	0.196	0.11	0.17
60° C (140° F.)	0.145	0.098	0.12

(ROSENGREN, L. F. *Tidskrift för Landtmän*, 1903, p. 209.)

3. *Value of Weibull's method for the determination of the fat content of cream.* — Weibull's method, according to which the fat content is determined on the dried cream, may be advantageously employed in dairies with the aid of the balances used to determine the amount of water present in butter. Provided it is certain that the cream has not been watered, the method, which is rapid and sure, lends itself especially to the control of the fat content of cream sold directly from the dairy. (ROSENGREN, L. F. *Landtbr. Akademiens Handl. och Tidskr.*, 1910, p. 71).

4. *The ordinary method for determining the amount of impurities* in the milk is probably weighing the sediment obtained by various means from a certain quantity of milk. Considering that in this sediment there is a fairly considerable quantity of the undissolved salts of the milk, the figures representing the impurities are too high, if the sediment before being dried and weighed has not been treated, for instance, by a weak solution of hydrochloric acid. (ROSENGREN, Ulanderska mjölkrenaren.—*Meddelande* No. 8 *från Maskin och Redskapsprofningarna*).

5. *Ripening of the cream at low temperatures.*— In 1899 the so-called fermentation at a low temperature, about 10-12° C. (50 to 54° F.) was introduced into the Alnarp dairy and then gradually into most of the Swedish dairies. If the cream has been pasteurized and then cooled to this point, its temperature will rise again by some degrees during ripening, independently of the surrounding temperature, so that it becomes suitable for churning.

By this method of ripening, a saving of labour and of refrigerators is effected in comparison with ordinary ripening at a higher temperature, which necessitates a cooling of the cream before churning. At the same time the danger of carrying acidification too far is avoided. The lactic ferments employed for the ripening of cream develop at a temperature as low as 9 to 10° C. (48 to 50° F.), and fast enough to allow cream to which 5 to 10 per cent. of ferment has been added and which has been stirred from time to time during the first hours, to be ready for churning within 18 or 20 hours (ROSENGREN, L. F. *Berättelse öfver Svenska Smörprofningarna år* 1900).

6. *Keeping the lactic ferment.* — Among the most effective measures to keep a culture of lactic ferment which will be employed for ripening cream

the very frequent stirring of the culture after transplanting it into some pasteurized skimmed milk must especially be mentioned, as it renders the development of the lactic acid bacteria more active and forms the best defence against injurious micro-organisms. When the conditions favourable to the development of the ferment have ceased or the milk has curdled, the culture of the ferment must be considerably cooled. (ROSENGREEN, L. F. *Berättelse öfver Svenska Smörprofningarna*, 1898).

7. *Influence of a too acid ferment on the butter.* — A very common defect of butter, which depreciates it greatly, is the taste of malt. In examining the conditions under which this taste appears, the writer has found that it is caused by the prevalence of the lactobacilli over the streptococci in the ferment used to ripen the cream. His researches have demonstrated that the development of the lactobacilli is promoted by the strong acidification of the milk, which does not suit the streptococci. If the ferment is allowed to become too acid several times before it is sown into the pasteurized milk, the lactobacilli predominate more and more over the streptococci and are besides generally accompanied by yeasts. The use of such a vitiated ferment to start the ripening of the cream causes, according to the researches of the writer, the above-mentioned defect in the butter. (ROSENGREN, L. F. in *Landtbr. Akademiens Handl. och Tidskr.*, 1911, p. 596).

8. *The water content of butter* depends, according to the writer's investigations, upon the following circumstances :

a) The content in water increases as the working up becomes more energetic; the greater the speed of the roller of the butter-worker the more continuous the work and the more the butter passes between the rollers in large lumps. It diminishes if the butter is worked in small masses and if an interruption of the work allows the brine to escape.

b) The water content diminishes, the firmer the butter when it is worked up.

c) The degree of moisture in the butter when placed on the worker; the higher this is the more water will the butter contain.

d) The adhesiveness of the liquid in the worked butter increases its retention by the butter; consequently an unwashed or a badly washed butter will contain more water than a well washed one.

e) Acid butter retains more water than a butter churned from sweet cream.

f) The addition of salt favours the draining of the water.

g) The draining off of the liquid is easier the larger the granules of butter, a butter consisting of small granules retaining water like a sponge. (ROSENGREN, L. F. *Berättelse öfver Svenska Smörprofningarna*, 1902, 1907).

9. *Influence of various kinds of concentrated foods on the butter.* — Soya cake has been used in amounts reaching 5 ½ lbs. per head per day without communicatng any special taste to the butter or in any way lowering its quality. (ROSENGREN, L. F. *Landtbruksakademiens Handl. och Tidskr.*).

Sesame cake has proved equal to earthnut cake as regards its influence on butter. (ROSENGREN, L. F. *Landtbruksakad. Handl. och Tidskr.*).

Peas, beans and vetches, of which as much as $8\,^3/_4$ lbs. per head per day have been included in a normal feeding ration, have not had any injurious action on the quality of the butter; they may in this respect be put on the same level as ordinary feeding cakes. Thus the experiments made have given no support to the wide-spread opinion that pulse imparts to the butter an inferior taste. (ROSENGREN, L. F. *Landtbruksakad. Handl. och Tidskr.*, 1912, p. 592).

10. *Refrigeration of butter.* — In order to keep the butter good for the weekly exportations refrigerating safes are used for storing the barrels. The writer has made some experiments on the cunsumption of ice and the changes of temperature in such a safe built with double wooden walls about 3 inches apart and containing 300 to 350 lbs. of ice and holding four barrels of butter. He caused it to be filled with ice the first day and did not have any more ice added during the seven days that the experiment lasted. During this time the average temperature kept at 6.3° C. (43.3° F.), varying from 6° to 6.9° C. (42.8° to 44.4° F.), the outer temperature being 21.2° C. (70.2° F.). The consumption of ice was 0.16 kg. per cubic metre and per degree of difference between the inner and the outer temperatures (0.005 lb. of ice per cubic foot per 1° F.).

When the insulating material (well rammed chaff), was removed, leaving only air insulation, the consumption of ice rose to 0.30 kg., that is to say almost double.

When the ice was mixed with 5 per cent. of salt, the inside temperature of the safe sank to below freezing point.

The temperature of the butter in the barrels sank from 16° C. (60.8° F.) to 14.5° C. (58.1° F.) the first day, to 11.6° C (52.9° F.) the second, to 10.6° C. (51.1° F.) the third, and to 10.3° C. (50.5° F.) the fourth day, the temperature in the inside of the safe being in this case 7.3° C. (45.1° F.) (ROSENGREN, L. F. *Berättelse öfver Svenska Smörprofningarna*, 1905).

11. *Control of the purity of the water used for washing the butter, in regard to salts of iron.* — In order to avoid the injurious influences of the salts of iron on the quality of the butter, the water used for washing it must not reveal the presence of iron when tested with potassium sulphocyanate. The examination is made, according to the writer, as follows: 20c. c. of water are boiled in a test-tube after the addition of a few drops of bromine water; a few drops of hydrochloric acid and 1 to 2c. c. of a solution of potassium sulphocyanate are then added, the mixture is shaken and mixed with 5c. c. of ether and again shaken. The ether, on separating out from the aqueous solution, must not be sensibly coloured by the iron sulphocyanate. (ROSENGREN, L. F. *Berättelse från Alnarps Landtbruks-och Mejeriinstitut*, 1909).

12. *Use of cultures of lactic ferments in cheese making.* — Since 1899 cultures of lactic ferments have been used in the Alnarp dairy for the preparation of various kinds of cheeses. These cultures consist of the common lactic ferment, *Streptococcus lacticus.* The intense feeding of the cows, leading to the production of a milk less suitable for cheese-making, has rendered the use of cultures of lactic ferments absolutely necessary for the successful manufacture of cheeses of a uniform character.

Cultures of lactic ferments are employed with good results in a great number of Swedish dairies. In 1902 experiments were begun with the bacillus Σ Freudenreich, and they have confirmed the opinion of v. Freudenreich and d'Orla Jensen on the importance of these organisms for the manufacture of cheeses of the Emmenthal type.

13. *Coating cheeses with paraffin.* — Since 1905 all kinds of hard cheeses made at the Alnarp dairy have been coated with paraffin. Experience has shown the utility of this treatment, the success of which, however, depends upon various circumstances. The temperature of the paraffin bath into which the cheeses are plunged must not be inferior to 130° C. (266° F.) and the cheese must be well cleaned, dry and not acid, because acidity leads generally to the exudation of moisture which detaches the paraffin coat.

The coating must be renewed as soon as the previous coat cracks or gets otherwise spoiled.

It may be estimated that the usual loss of weight during storage is diminished by about 10 per cent. by this treatment. The quality of the cheese is improved and the deterioration of cheese due to mites and moulds is avoided; at the same time the work of handling the cheese in the store house is lightened.

65 – **Determination of the Amount of Water added to Milk based on the Degree of Acidity.** — GERÖ, VILMOS in *Kisérletügyi Közlemények*, Year XVI, Part 5, pp. 663-664. Budapest, September-October 1913.

Among the available means for determining the amount of watering to which milk has been subjected, the specific gravity of the serum and the refraction are undoubtedly the most trustworthy. The other analytical factors should correspond, but they are often liable to oscillations. It is also impossible to found a sure judgment on the ash content, especially when the milk has been adulterated with well-water containing much mineral matter.

In order to determine the degree of freshness of the milk, especially in summer, the writer has determined its acidity by Thörner's method; he observed that the acidity of watered milk is much below that of pure milk. In Hungary the amount of acidity of the milk on sale varies between 17 and 22°, whilst milk adulterated with water shows less than 15°, and when much water has been added, the acidity sinks to 13, 12 and even 10°.

In support of the above, the writer shows in the following table the results of some analyses of milks made in the year 1909, which was a year in which adulteration was frequent.

Of course, the degree of acidity, like the other factors, has not an absolute value and it may happen sometimes that watered milk marks 15° and even more, while fresh milk submitted immediately to analysis marks some degree below normal (15°). Nevertheless this has never been observed when the samples were taken on the market.

In summer, when the process of acidification is more rapid, it might be believed that the acidity of adulterated milk would be high; whereas in reality such is not the case, because the acidification of adulterated milk

Number	Specific grav ty	Fat	Total solids	S. G. of serum	Nitrate reaction	Degree of acidity
4	1.0252	4.4	11.83	1.0208	strong	10.0
8	1.0270	3.1	10.72	1.0226	strong	12.0
21	1.0240	2.8	9.60	1.0205	strong	10.5
22	1.0219	2.65	8.71	1.0190	weak	9.0
35	1.0240	3.7	10.68	1.0190	strong	10.0

is slow. This same fact is also been observed in the preparation of curdled milk: normal or skimmed milk curdles rapidly, whilst the coagulation of watered milk lasts twice or thrice as long. The result of all these observations is that if the degree of acidity is minimal and it agrees with the other data it may serve as a basis for the valuation of the milk.

66 - **The Relationship between the Bacterial Flora of Milk and of the Pasture.** — WOLFF, A. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 39, No. 15-17, pp. 411-419. Jena, November 29, 1913.

The writer has made a comparative bacteriological investigation of the pasture grass and the milk of cows grazing upon the latter, and has been able to establish a fairly close connection between the flora of the milk and that of the grazing ground. In addition to those bacteria (*Coli-aerogenes* group) which occur regularly in the milk and on the pasture alike, there are other specific pasture bacteria only to be found in the milk during the grazing season. As such may be mentioned *Bacterium trifolii, fulvum, herbicola Burri, lactorubefaciens*, and the short rod-like form inhabiting the common daisy. The similarity between the flora of the pasture and that of the milk depends largely upon the handling of the milk and of the udder; it is usually greatest when such treatment is least good.

There is much less similarity between the flora of the milk and fodder of stall-fed cows than exists between the bacteria present in the pasture and the milk of grazing animals. This is chiefly to be attributed to the fact that the fodder comes less in contact with the udder in the stall than does the grass in the pasture. A closer relationship exists, in the case of stall-fed cows, between the milk and litter floras than between those of the milk and the fodder.

67 – **The Composition of Ewes' Milk Sold in Hungary** (1). — BIRÓ, GUSZTÁV in *Kiserletügyi Közlemények*, Year XVI, No. 5, pp. 656-662. Budapest, Sept.-Oct. 1913.

Considering that in the great plain of Hungary, besides cows' milk, ewes' milk is also a staple article of trade, the Municipal Laboratory of agricultural chemistry of Kecskemet has undertaken the systematic analysis of the ewes' milk sold, in order to become acquainted with the approximate composition of whole ewes' milk. The greatest number of samples for analysis were taken without any selection at the local market from the mixed milk of the producers and of the retailers, whilst a very small quantity was taken when the control of milk was carried out. The most part of these control samples were compared with those taken in the sheep-folds, the latter generally containing a little more fat than the control samples. This difference was however very small (0.4 to 0.8 per cent.) and it may be attributed partly to the ordinary variations in the composition of milk and partly to the handling.

The following table shows the average composition of the whole ewes' milk sold on the Kecskemet market between April and August, and the extreme values of a series of analyses:

	S. G. of milk — 15° C.	S. G. of solids	S. G. of whey — 15° C.	Total solids	Fat	Total solids not fat	Ash	Fat content of total solids
Average	1.0361	1.2210	1.0330	19.70	7.87	11.85	0.75	39.79
Minimum	1.0326	1.1597	1.0302	17.09	5.65	9.48	0.68	27.07
Maximum	1.0406	1.2649	1.0355	22 98	10.45	13.82	0.88	54.30

68 – **Complete Churning and Questions Connected with it.** — ROSENGREN, L. F. in *K. Landtbruksakademiens Handlingar och Tidskrift*, Year 1913, No. 4, pp. 254-275. Stockholm, 1913.

The writer shows that the completeness with which the fat contained in milk passes into the butter cannot be ascertained with certainty by the fat content of the buttermilk, nor by the quantity of fat contained in the dry matter of the buttermilk, because both vary considerably according to the fat content of the cream and to the quantity of cream that has been taken from the milk. Thus the absolute quantity of fat remaining in the buttermilk derived from 100 lbs. of milk is the only evidence of the degree of churning which can be trusted. In Sweden it is considered that 1 oz. of fat in 125 lbs. of milk is the highest figure which should be found after satisfactory churning.

(1) See No. 585, *B*. May 1913. (*Ed.*).

The writer mentions several ways of calculating the percentage of cream obtained by skimming and the quantity of fat that remains in the buttermilk, and gives tables of the quantities obtained under different conditions.

Among the factors which influence the amount of butter made (Ausbutterungsgrad), the temperature at which churning is done is the most important. Too high a temperature is usually the cause of cream being less completely transformed into butter; it is especially so since the adoption of the combined churn and butter-worker, which allows churning at a relatively high temperature without any inconvenience to the quality of the butter and the manner of treating it.

It has been proved by experiments that churning at a temperature of 15° C. (59° F.) yielded 0.78 parts of fat in the butter-milk from 100 parts of milk, against 0.40 parts found after churning at 11° C. (51.8° F.), that is 4 ½ lbs. of butter in 100 gallons of milk.

Nevertheless, 11° C. (51.8 °F.) is not always the most favourable temperature for complete churning. Only a careful control of churning in every particular case will reveal the most suitable temperature. In general this temperature must be lower, the less the cream has been cooled before ripening, the higher the temperature of ripening, and the more the fat, owing to its chemical composition, lacks cohesion.

Even in those cases in which cream ripens at a temperature as low as 10 to 13° C. (50 to 55.4° F.) the temperature rises to such a degree during the process of ripening, especially in hot weather, that it is necessary in view of complete churning to cool the cream before straining it into the churn.

If the temperature of the cream has to be lowered by only 2 to 4° C. (3.6 to 7.2° F.), direct cooling by means of ice is the most suitable. About 20 lbs. of ice are required to cool 500 lbs. of cream at 57° down to 52° F. Of course the ice used for this purpose must be made with pure water, free from germs, preferably pasteurized water; this must also be without chemical impurities, especially salts of iron. In cases in which no ice machine is availabe, the best and cheapest way to make artificial ice is by placing a pan filled with water in a mixture of 100 parts of natural ice, 10 parts of coarse salt and 30 parts of water. The writer describes a simple apparatus for making ice in this way, by means of which he has obtained 66 lbs. of artificial ice by using 100 lbs. of natural ice.

Experiments have shown that the quantity of fat remaining in the buttermilk during churning was the same whether the cooling was performed by an ice bath or by ice being placed in the cream.

In order to obtain complete churning, some dairies, instead of cooling the cream, skim the buttermilk; by this method the amount of fat remaining in the buttermilk has been diminished from 0.79 to 0.46 per cent. The skimming has to be carried out at a low temperature, in order to avoid the coagulation of the buttermilk, which would reduce the separation of the fat to one-half or one-third of what couold be obtained by the usual machine separating. Besides, the salts of iron give the butter a bitter taste. Mixing

the cream skimmed off from the buttermilk with normal cream, as is commonly done, results in imparting a metallic taste to all the butter.

The fat content of the cream is also important for the completeness of the churning. Very poor and very rich creams are less completely churned than average ones.

It is supposed that if pasteurized cream allows of less complete churning than another cream, it is due to the amount of work to which it has been submitted, especially in the pasteurisers, which cause the cream to rise and whose stirrers revolve at a very high speed. This observation has been confirmed by experiment, for the greater the quantity of cream that could be treated by the pasteurizer in a given time, the more complete was the churning; on the other hand the speed of the stirrers had no effect whatever.

The extent to which the churn is filled also exerts an influence, at least in the rotary churns (barrel churns). The churning was less complete when the churn was less full, especially when the cream had a high fat content.

The writer lastly points out that among the large mechanical churns, the Danish churn and the modern combined churn and butter-worker also give a good complete churning; nevertheless, the former requires more scrupulous care in the handling than the latter. On the other hand the combined churn and butter-worker, when it is not quite full and when the cream is very rich, may give a less complete churning owing to the fact that it is more difficult to churn completely the cream which adheres to the projecting blades, to the axle, etc. This difficulty is overcome if towards the end of the operation the churn is given a few turns in the contrary direction; the washing is then more complete and the churning becomes satisfactory.

69 – **Promoting the Formation of Eyes in Emmental Cheeses.** – STEINEGGER in *Schweizerische Milchzeitung*, Year 39, No. 88, p. 1. Schaffhausen, November 4, 1913.

The writer recommends, on the basis of practical experiments, the addition of casolin to the rennet as a means of obtaining Emmental cheeses well and uniformly provided with eyes and able to stand storage. Casolin is found in trade; it is a mixture of acids which has no injurious effect on the taste and fineness of the cheese, or on the process of making it. Cheeses made with casolin begin to ferment in the warm cellar eight or ten days sooner than the others, and consequently the formation of the eyes begins sooner; it proceeds steadily and normally; after-fermentations in the cellar do not set in.

The rennet is prepared as follows: the stomach is placed in a suitable vessel and 300 c.c. of whey at 30° C. (86° F.) are poured over it; 2 to 4 c. c. (according to the eye formation desired) of casolin are then added and the mixture is stirred and kept for three hours at 30° C., shaking it every now and then. Then the usual amount of whey at 30° C. is added and the rennet is kept at the temperature required by circumstances. The rennet thus prepared is of perfect composition; it does not present floating pieces of stomach, nor has it any bad smell or taste. It possesses mostly an acidity

of 30 degrees, and when the casolin has been aded in a proper quantity, it never causes swelling or ropiness of the cheese. Casolin keeps good for a long time.

SUGAR INDUSTRY.

70 - **The Use of Hydrosulphites in the Manufacture of Beet Sugar.** — MARCUS, P. in *Journal des Fabricants de Sucre*, Year 54, No. 47, p. 1. Paris, November 19, 1913.

This paper is not a complete study of the whole question. The writer limits himself to the demonstration of the advantages realized at the sugar factory of Port-Salut-Verberie by the use of hydrosulphites at the commencement of the work of purification.

This operation costs about 1*d* per ton of beets, and allows of a saving of 30 per cent. on the limestone and 32 per cent. on the coke; there follows a corresponding decrease in the scums, in the loss of sugar in the cake, of the water required for washing it and in the expense of the filtering mass in the press filters. Calculated per ton of beets, these savings work out as follows:

	d.
Stone and coke	3 3/4
Sugar in the scums	1 1/4
Water (economy of fuel)	1
Filters	1/2
	6 1/2 *d*

Account should also be taken of the more rapid evaporation and of the almost complete suppression of incrustations, which involves an economy of fuel. But it is only in a well-conducted factory that hydrosulphites can be of use.

PLANT DISEASES

GENERAL INFORMATION.

71 - **Modification of the Laws on Phylloxera Control in Italy.** — Legge del 26 giugno 1913, n. 786, che approva modificazioni al testo unico delle leggi 6 giugno 1901, n. 355, e 7 luglio 1907, n. 490, approvato con R. decreto 17 maggio 1908, n. 343, sui Consorzi di difesa della vitticultura; ed al testo unico, emanato con R. decreto 4 marzo 1888, n. 2552 (Serie 3ª), delle leggi intese ad impedire la diffusione della fillossera. — *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year XII, Vol. II, Series A, Part 11-12, pp. 338-340. Rome, September 13-20, 1913.

LEGISLATIVE AND ADMINISTRATIVES MEASURES.

Art. 1. — The Antiphylloxera Societies, constituted in accordance with Arts. 2, 3 and 4 of the laws of June 6, 1901 (No. 355), and July 7, 1907 (No. 490), may benefit by loans repayable in 25 years for the purpose of enabling them to establish nurseries for the production of American stocks with which to reconstitute vineyards attacked and destroyed by phylloxera.

The Ministry of Agriculture, Industry and Commerce, shall fix, according to the report of the Consultative Commission on Plant Diseases (1), the amounts to be granted to each Society or Federation of Societies.

The necessary funds for the loans will be furnished by the Treasury of Deposits and Loans (" Cassa Depositi e Prestiti ") at an interest not exceeding 4 per cent., and they shall not exceed 3 million francs a year, or a sum total of 16 millions.

The budget will include a special clause dealing with the grants of the Treasury of Deposits and Loans placed at the disposal of the Ministry of Agriculture for the purpose of loans to the Societies. The budget of the Ministry of Agriculture shall also include a corresponding clause concerning the payment of the loans to Societies after due approval of their work.

Any balance remaining at the end of a year shall be carried forward to the following year's account.

Art. 2. — The interest on the loans shall be paid to the Treasury of Deposits and Loans in July of each year by the Ministry of Agriculture, who will enter it in a special clause of the budget.

(1) See No. 413, *B.* Feb. 1912. (*Ed.*)

Seventy-five per cent of the annuities is charged to the Ministry of Agriculture and the remainder to the borrowing Societies, whose contributions will be guaranteed by assignments made over to collectors. To be entitled to the loan, the Society must undertake to pay according to Art. 12 of the law of May 17, 1908 (No. 343), for 25 years the contribution which shall be at least equivalent to the amount of the annuity due to the Treasury.

Art. 3. — Societies of any particular province or district may combine to form a Federation. These Federations may in the interests of Societies requesting it, negotiate loans according to the conditions of the preceding articles. Each Society will make its own payments by means of assignments according to Art. 3.

Art. 4. — For three years after the law has come into force, the Federations and Societies may obtain from the Ministry of Agriculture reimbursement to the extent of two-thirds of the cost of the American vines distributed to their members for the reconstitution of vineyards destroyed by phylloxera.

Art. 5. — The Federations of Antiphylloxera Societies of each Region may nominate, subject to the approval of the Ministry of Agriculture, a technical agent for the direction of protective measures for the vineyards of the Region.

The Federation shall be directed by a Regional Committee composed of three members: one appointed by the Provincial Deputations, a second by the Antiphylloxera Societies, and the third to be the technical agent. The Minister of Agiculture may, when he considers fit, appoint a special delegate to represent him on the Committee, who has the right to vote.

The Provincial Commissions shall consist of three members: one nominated by the Ministry of Agriculture, a second by the Provincial Deputation, and the third by the Antiphylloxera Societies. The administration of each Society shall be in the hands of a Commission of five members.

Art. 6. — To provide for the expenses anticipated according to Art. 2, a special clause will be included in the budget of the Ministry of Agriculture for 1913-14, granting the sum of 192 000 francs for each financial year until a sum total of 1 536 000 francs is reached.

To meet expenditure anticipated under Art. 4, a grant of 450 000 francs under clause 50 of the financial year 1912-1913 in the budget of the Ministry of Agriculture will be made, beginning with the financial year 1913-1914.

Art. 7. — No indemnity will be paid to proprietors for vines destroyed in infected and protected zones; the latter may not be more than 10 metres (33 ft.) in width.

At the same time the Ministry of Agriculture may grant special subsidies, in accordance with rules to be fixed by an enactment, for the destruction of vines in vineyards belonging to small proprietors or cultivated directly by small tenants.

Art. 8. — In the case of outbreaks over limited areas or threatening large areas of unattacked vines, the Ministry of Agriculture may on the suggestion of the Provincial Deputation appoint a Local Commission consisting of five members representing respectively the Ministry of Agriculture,

the Ministry of Finance, the Provincial Deputations, the Antiphylloxera Society and the vine-growers in the infected district. This Commission is responsible for arranging and carrying out the preventive measures.

The Ministry of Agriculture may delegate to it power to destroy infected and protected zones.

In the provinces possessing Antiphylloxera Societies, the Provincial Commission assumes the above-mentioned powers. The President of the Society in the infected region and the Provincial Councillor will take part in the proceedings of the Commission.

The expenses incurred in the destruction of vines under these circumstances shall be provided for by the Ministry of Agriculture, to be reimbursed in the proportions of 40 per cent. by the province, 10 per cent. by the Society, and 50 per cent. by the State.

The repayment of the sums due to the Treasury by the province and the Society will be effected by assignments to their respective collectors.

Art. 9. — This deals with the powers of the government to regulate various conditions concerning the laws affected.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

72 — **Partial Damages of Frost on Winter Cereals resembling Damage by Wild Animals.** — ZIMMERMANN in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIII, Part 6, pp. 332-334, plates IV-VI. Stuttgart, 1913. DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

The German Stations of Phytopathology frequently receive in winter specimens of winter grain (chiefly rye) supposed to be damaged by wild animals, in particular rabbits. Such plants are generally found to be in the last stage of a leaf disease induced by frost.

The action appears to be as follows: in periods of frost without much snow, parts of the blade (generally the tip) become discoloured by destruction of the chlorophyll, and eventually die. If the weather is damp, fungi such as *Septoria* and *Cladosporium* develop on these parts and may invade the healthy tissue to some extent; but in dry weather the diseased parts shrivel up and drop off, thus producing an effect similar to nibbling by rodents.

The crops which recover best from this frost damage are those that have developed well owing to early sowing or to the frost coming late. Crops on light soil seem to be more susceptible, while rye after rye or oats seems not to recover so well as after other crops.

BACTERIAL AND FUNGOID DISEASES.

FUNGI.

73 – The Occurrence of Rust Spores in the Interior of Wheat and Barley Grains. – BEAUVERIE, J. in *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 18 (Nov. 3, 1913), pp. 787-790. Paris, 1913.

Continuing the observations made in 1912 (1) in the district of Beynost (Ain), the writer found large numbers of cereal grains containing the mycelium or uredo and teleuto-sori of rust. To detect their presence in wheat grains it is necessary to cut sections, since the fungus is localised more or less deeply in the pericarp and parenchyma of the groove. The writer has been able to show that the mycelia and spores belong to *Puccinia graminis*.

All the six-rowed barleys examined showed the presence of uredospores of *P. glumarum* in rows between the veins of the pale; the sori actually develop on the inside of the pales, but owing to the fusion of these with the pericarp they come to lie within the grain and are turned towards the interior. In the case of two-rowed barley *P. glumarum* was found on the stems, while the ears remained free. The writer has observed a similar attack on *Bromus mollis* and *Agropyrum*, but the sori were not as readily visible to the naked eye as in the case of barley.

In all cases where the caryopses were attacked by the mycelium, it was observed that this did not spread into the albumen or the embryo; it appears to be stopped in its progress by the tough membranes surrounding the aleurone layer of bare caryopses and by the adjacent epidermal layers of the pale and pericarp in covered grains. It is only when this protective layer is broken (as in threshing) that the mycelium can penetrate.

The writer is thus led to infer that on all fruits of Gramineae attacked by *Puccinia* the sori are turned towards the interior. The dehiscence of these sori can only take place as a result of the destruction and decomposition of the layers of cells covering them; this only takes place by bacterial or other decomposition after the seed has germinated.

Finally it appears that the occurrence of rust spores within the caryopsis may be of considerable practical importance from the point of view of the spread of the disease.

74 – Contribution to the Biology of Naked Smut of Barley *(Ustilago nuda)*. — BROILI, J. and SCHIKORRA, W. in *Berichte der deutschen botanischen Gesellschaft*, Vol. XXXI, Part 7, pp. 336-339, 1 fig. Berlin, 1913.

This is a preliminary communication of the results of researches into the biology of naked smut of barley begun by Broili at Jena and continued by him at Bromberg in collaboration with Schikorra.

Sections of caryopses, when treated with chloral hydrate, immediately show the presence or otherwise of the fungus. Out of 409 caryopses from ears artificially infected, 162 showed the presence of mycelium.

(1) See No. 879, *B*. July 1913. (*Ed.*).

Broili had already observed that on ears artificially infected the glumes very often became partially separated. In 1913 this was used as a basis of selecting grains suspected of infection: of 21 selected grains, 13 produced smutted plants. With commercial seed it has been possible by using this character to reduce the percentage of infected plants from 2.3 to 1.6, as shown by field trials in 1913.

The distribution of mycelium in the seeds and seedlings was worked out by staining microtome sections with gentian violet and methyl orange. These researches have shown that the mycelium in resting and germinating seeds is especially abundant in the region of the scutellum, but is also present in various parts of the embryo.

To induce growth of the dormant mycelium in the grains, portions of tissue as nearly sterile as possible were sown onto potato media and nutrient agar and gelatine. Pure cultures were obtained from all. The cultures from different grains all produced the same characteristic growth of the fungus. Inoculation experiments were undertaken to confirm its identity with the original smut: potato cultures were used for inoculating various parts of the growing stems, and the pistil during flowering. The identity of the fungus was also confirmed by observations on the nuclear condition of the cells, which were found to correspond with that given by Rawistcher for *Ustilago Maydis*.

On the duration of vitality of the fungus no new information has been obtained. The attack of the disease on the crop of Bethge II barley sown at Bromberg in 1913 from the seed of the 1908 harvest appeared in the same percentage (2.3) as the crop of the same seed sown in 1909.

The method of inducing growth of the quiescent mycelium in the caryopses will be useful in testing the action of means of destroying smut; it is thus easy to determine if the mycelium has been damaged or killed.

75 - ***Cicinnobolus* sp. Parasitic on Apple Mildew *(Oidium farinosum)*.** — OBERSTEIN, O. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIII, Part 7, pp. 394-396. Stuttgart, November 18, 1913. MEANS OF PREVENTION AND CONTROL

After enumerating the species of *Cicinnobolus* described in previous years as parasitic on other injurious fungi — *Cicinnobolus* sp. on *Sphaerotheca mors-uvae* (1), *C. Cesatii* f. *Euonymi* on oak mildew (2), *C. Kusanoi* on *Oidium* sp., *C. Abelmoschi* on *O. Abelmoschi* (3) — the writer records as new the occurrence in Prussia of *Cicinnobolus* sp. on *O. farinosum*. This case was observed on apple twigs attacks by *Oidium* (4) in the districts of Bernsdorf and Trebnitz.

(1) See No. 300, *B.* Jan. 1911.

(2) See No. 998, *B.* March 1911.

(3) See No. 240, *B.* Jan. 1912. In addition to the above species, *C. bremiphagus*, on *Bremia graminicola*: cf. No. 878, *B.* July 1913.

(4) See No. 1356, *B.* Sept. 1912. (*Ed.*)

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS.

76 — **Diseases and Pests of Plants in Belgium in 1911 and 1912.** — POSKIN, J. (Entomological Service) and MARCHAL, E. (Phytopathological Service). — *Ministère de l'Agriculture et des Travaux publics, Office rural, Rapports et Communications*, No. 7, pp. 59-85, figs. 1-2. Brussels, 1913.

The meteorological conditions during 1911 were quite different from those of 1912, the former year being hot and dry and the latter cool and wet.

Fungi. — In 1911 *Urocystis occulta* was very abundant on rye; *Puccinia glumarum* was more abundant on wheat than usual, while *P. graminis* was only occasional on oats. In 1912 the percentage of six-rowed barley attacked by *Ustilago Hordei* was high, whilst *U. Jensenii* on barley and *Puccinia graminis* on oats were less abundant.

Potato blight did not appear in 1911, but scab was prevalent, and the same may be said of heart-rot of beets. Owing to the heavy rainfall in 1912 potatoes were in some cases blighted to the extent of 40 per cent. of the crop; *Macrosporium Solani* was noticed in great abundance for the first time, without doing serious damage. The nearness of centres of infection of wart disease (*Synchytrium endobioticum*), which has not yet been found in Belgium, induced the authorities to make known among farmers the characters of this serious disease.

Endives suffered considerable loss in 1912 from *Aecidium Lactucae-sativae*.

In 1911 *Exobasidium Azaleae* was common on azaleas, and in 1912 a fungus identified as *Pyrenochaeta Bergevini* on *Aspidistra*.

Sphaerotheca mors-uvae did not appear in 1911, but in the following year it almost everywhere completely destroyed the gooseberry crop. In 1911 *Aecidium Grossulariae* was also common on *Ribes* and *Gymnosporangium Sabinae* on pears; *Septoria piricola* was rare. The "Rhine disease" of cherries, not yet well known, also appeared in rare instances. The excessive heat produced frequent scorching of vine leaves, especially in low badly-ventilated houses.

Lophodermium brachysporum was recorded on *Pinus Strobus* for the first time in 1912; it does not do much damage.

Insects. — Roses were attacked by aphids, *Typhlocyba rosae* and Tenthredinids. The attacks of *Hyalopterus pruni*, *Myzus ribis* and *M. cerasi* on fruit trees were perhaps worse than usual. *Aphis mali* was unusually bad, while *Schizoneura lanigera* continues to spread.

M. Poskin had already recorded that native oaks were seriously menaced by *Heterognomon viridana*, *Coccus quercicola* and mildew, especially on calcareous soils; in the neighbourhood of Valenciennes, the Buprestid *Agrilus biguttatus* has also been very harmful. The following insects have been observed on *Quercus palustris*: *Trypodendron domesticum*, *Xyleborus dispar*, *Ips quadripunctatus*, *I. quadriguttatus* and *Soronia grisea*.

Mammals. — Ranysz virus has been found efficacious against rodents, including rats, in various places.

77 – **Inquiry and Observations on Straw Blight of Wheat** (1) **in the Department of Aisne, France.** — GUERRAPAIN, A. and DEMOLON, A. in *Journal d'Agriculture pratique*, 1913, Vol. II, No. 44, pp. 566-567, 1 fig.; No. 46, pp. 627-630. Paris, October 30 and November 3, 1913.

The writers have made a very general inquiry by means of correspondents on the disease known as "piétin" or "pied noir" (straw blight), which has for some years been so rampant as to cause alarm among the farmers of the Department of Aisne. In 1913 this disease reduced the crop by 5 to 10 per cent., and in some cases even 60 per cent.

The following questions were discussed in the inquiry: influence of climatic conditions, distribution of the disease, effect of soil and cultural conditions(season, density of sowing, varieties of wheat grown, manures), plants attacked, effect of the preceding crop, efficacy of copper sulphate.

From a consideration of the information received from their correspondents the writers remark that, although no remedy has yet been found, the agriculturist is not quite defenceless. The following causes appear to favour the development of the disease: *a*) an abnormally mild winter; *b*) excessive growth early in the season owing to early sowing, excess of nitrogen and the particular variety grown, etc.; *c*) infection of the soil, chiefly where winter grain (especially wheat) is taken frequently: the manure and the stubble contain the source of infection.

On the other hand, the following factors tend to diminish the spread of the disease, either by protecting the plant against infection or by making it more resistant: *a*) early and hard winters; *b*) not sowing the crop too soon: land which has been previously attacked should not be sown first; *c*) avoiding excessive growth of the corn before winter: a dressing of superphosphate and nitrate of soda may be given in the early spring; *d*) thorough ploughing-in of the manure and stubble in preparing for wheat; *e*) in badly infested land, lengthening the rotation, taking some such crop as lucerne.

There is little probability that any practical remedy can be found. According to the writers it is better to adopt preventive measures, which will be easier to carry out when more complete knowledge of the mode of infection has been obtained.

78 – ***Stilbum flavidum*, Parasitic on Coffee, and its Systematic Position.** — MAUBLANC, A. and RANGEL, E. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half year, Vol. 157, No. 19 (Nov. 10, 1913) pp. 858-860. Paris, 1913.

Stilbum flavidum Cooke is well known throughout tropical and subtropical America as the cause of roundish dry spots on the leaves of coffee. The writers have recently studied this fungus in the neighbourhood of Rio de Janeiro on coffee and other plants (*Eriobotrya japonica* and various Melastomaceae, Compositae and Rubiaceae). There is little doubt that *S. flavidum* occurs naturally in the forests on various shrubs. This origin

(1) See also No. 731, *B.* April 1912 and No. 1103 *B.* Sept. 1913. (*Ed.*)

explains the local distribution of the fungus, which in Brazil occurs chiefly in the coastal regions, where it finds the heat and moisture necessary for its development.

All attempts at classification had been unsuccessful owing to the sterility of the fungus. In moist chambers the writers have at last obtained fructifications of a typical Agaric, the characters of which refer it to the genus *Omphalia*; it apparently constitutes a new species (*O. flavida*). The resemblance in colour and the position of the basidiomycetes on the edge of the spots, as well as the occurrence in some of the spots of all intermediate stages between *Stilbum* and *Omphalia*, lead the writers to consider that the former is merely an abortive and sterile stage of the latter. The absence of reproductive organs in the sterile form is compensated by the vegetative growth of the cells of the atrophied pileus, which becomes loose and may attach itself to other plants. This is their ordinary method of reproduction; the *Omphalia* forms always require very damp conditions, such as must be rare even in forests during the rainy season. The persistence of great humidity is not the only condition requisite for the development of the *Omphalia* fruits: it seems that they only develop on the edges of fresh spots, that is to say in the parts in which the mycelium is young and well nourished.

79 — ***Fusarium bulbigenum* on Narcissus Bulbs.** — MASSEE, G. in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 8, pp. 307-309, 1 plate. London, 1913.

This disease was first observed on Narcissus bulbs three years ago, but did not cause serious damage until this year. The fungus which destroys the interior of the bulbs was first described in 1887 as *Fusarium bulbigenum* Cooke and Massee, but it was not considered a parasite.

The first symptoms of the disease are yellowish spots which grow in size, become brown and develop pale salmon-coloured specks, at first gelatinoue and becoming brown and dry on exposure to the air. These specks are the spore masses of *Fusarium*, which spread the disease to neighbouring plants. The mycelium of the leaves grows downwards into the bulbs, where it develops rapidly in the fleshy scales. The first symptoms of attack in the bulbs are found round the neck, but the whole bulb soon becomes uniformly brown in colour. A delicate white mycelium is formed on the scales, in which are embedded the chlamydospores. The characteristic conidia of *Fusarium* also appear. The complete destruction of the bulb is soon completed by saprophytic fungi (*Penicillium*) and insects (*Rhabdites*).

The chlamydospores set free by the decay of the bulb germinate in the soil and produce secondary spores which infect the leaves of narcissi in the following spring.

Young leaves inoculated with the spores showed signs of the disease in six days, and the symptoms spread with the growth of the leaves. Mycelium was found in considerable quantity in the tissues one week after infection. It sems very probable that infection of the young leaves takes place by means of the secondary spores produced by the chlamydospores and that the successive infection of the lower parts of the plant and the bulb takes place

from spores washed down from the diseased patches of the leaves. Chlamydospores are also found abundantly in the leaf tissues. The spread of the disease may be effected in two different ways : either by spores of the fungus contained in bulbs only slightly diseased, or from infected soil.

The disease is well known in Holland, and it has probably been re-introduced into England in imported Dutch bulbs slightly infected.

80 - **The Rotting of Bunches of Grapes produced by *Phoma* sp., in Algeria.** — TRABUT, L. in *Bulletin agricole de l'Algérie et de la Tunisie*, Year 19, No. 17, pp. 341-342. Algiers, September 10, 1913.

In 1913 a serious disease broke out in a vineyard at Ténès (Algiers), causing the entire withering of the bunches ; the disease first appeared on the colouring fruit, and continued to develop after the fruit was ripe, causing a large portion to wither up. The petioles were also attacked in some cases, showing first a whitish tinge, then darkening; the leaves then dried up and fell off. The shoots and fruits were sprayed with copper sulphate several times, but without result.

On examining the tissues at the origin of the peduncle, the writer found a fungus with large spores easily recognised as a species of *Phoma*, resembling *Coniothyrium Diplodiella*, which causes white rot. Thus the writer attributes the damage to a specialised form of white rot. The fungus evidently causes a withering of the bunches by checking the flow of the sap. No trace of the parasite has been found on the leaves, but it is very probable that it attacks the petioles. This particular form of white rot is remarkable in that it does not attack the fruits, which simply wither.

More detailed study is required to determine the exact importance of this disease, its causes, and suitable means of preventing it.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

81 - **On the Germinating Power of Seeds of *Orobanche crenata* after passing through the Digestive Tracts of Cattle and after Fermentation in the Dung.** — MORETTINI, A. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVI, Part 9, pp. 599-606. Modena, 1913. PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

The writer has conducted experiments at the Royal Institute of Experimental Agriculture at Perugia, on the seeds of *Orobanche crenata*, which does a great deal of damage to beans in the centre and south of Italy (1). The object of these researches was to determine : *a*) if the seeds can resist the chewing and digestive processes when eaten by cattle ; *b*) if the germinating power of the seeds is affected in the subsequent action of the dung and litter.

From the results of experiments carried out from 1911 to 1913, the writer concludes that the germinating power of the seeds is not affected in

(1) See No. 867, *B.* May 1912 and No. 1362, *B.* Sept. 1912. (*Ed.*).

passing through the digestive tract of cattle when eaten with ordinary forage, the majority of the seeds being expelled within 12 to 48 hours after ingestion. On the other hand they lose their power of germination when subjected to the fermentative changes of the dung. They are also affected similarly when immersed in the liquid manure.

The destructive action of the dung is equally efficacious if the seeds are mixed with it when it is already partially decomposed. In actual practice, therefore, decomposed dung is not an agent for dispersing the seeds as is the case with fresh dung. Thus there is no danger from throwing the fruit capsules of *Orobanche* into dung heaps that are well conserved, though their destruction by more certain means is always preferable.

The writer concludes that, considering the anatomical and physiological affinities among the better known species of *Orobanche*, similar means may be adopted for destroying the seeds of the other species parasitic on crops.

82 – ***Fagopyrum tataricum*** **as a Weed among Buckwheat in Vohynia (Russia).** — KAMESKY, K. in *Wissenschaftliches Comite des landwirtschaftlichen Ministeriums, Bulletin für angewandte Botanik*, Year 6, No. 7, pp. 496-497. St. Petersburg, 1913.

In the summer of 1912 the writer observed *Fagopyrum tataricum* (1) as a fairly abundant weed in fields of buckwheat in Volhynia, though the species had not been definitely recorded before from the district. It seems very probable that it has been imported into this district, as into other parts of Russia-in-Europe (Chernigov, Kursk, Yekaterinoslav, Kherson, Don), though it is indigenous to Siberia.

INSECT PESTS.

GENERALITIES.

83 – **First Annual Meeting of the " Deutsche Gesellschaft für angewandte Entomologie ".** (2) — *Communicated to the International Institute of Agriculture.*

The German Society of Applied Entomology (" Deutsche Gesellschaft für angewandte Entomologie ") held its first annual meeting from the 21st to the 25th of October, 1913, at Würzburg, Bavaria.

By invitation of the German Pomological Society, Eisenach (Saxe-Weimar), was chosen as the place for the next annual meeting of the Society. The presidency of Doctors Escherich, Schwangart and Heymons, hitherto provisional, was confirmed at the meeting, and in addition Doctor Winter of Frankfort was appointed secretary. A special commission was appointed for studying questions relating to the organization of Applied Entomology in the different branches of agriculture, colonial entomology and medicine, as well as the breeding of beneficial insects.

A considerable sum was contributed towards funds for the maintenance of travelling research studentships.

(1) See also No. 1401, *B.* May 1911. (*Ed.*).
(2) See No. 890, *B.* July 1913. (*Ed.*).

MEANS OF PREVENTION AND CONTROL.

84 - ***Bacillus Gortynae, B. Pyramsis I* and *B. Pyrameis II*, parasitic on the larvae of *Gortyna ochracea* and *Pyrameis cardui*.** (1) — PAILLOT, A. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half-Year, Vol. 157, No. 15, pp. 608-611. Paris, October 1913.

The writer describes the morphological and cultural characteristics of three new bacilli, isolated from the tissues of the larvae of *Gortyna ochracea* and *Pyrameis cardui*. The former caused a small epidemic amongst the larvae in May 1913. There is little to distinguish the diseased larvae in the early stages, but in the later stages the movements gradually become weaker; after death the body decomposes forming a blackish mess. Inoculation of healthy larvae with serum containing the bacilli from diseased ones does not always produce infection, though it is always successful with the larvae of *Lymantria dispar*.

85 - **climatization of *Novius cardinalis* in France.** - MARCHAL, PAUL in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 15 (Oct. 13, 1913), pp. 561-564. Paris, 1913.

The writer gives the results of the campaign of 1912 in the South of France (Alpes-Maritimes) under the Direction of the Scientific Service of the Ministry of Agriculture for the Control of *Icerya purchasi* (2) by means of *Novius cardinalis* (3).

A succession of supplies of this ladybird was obtained by the Paris Entomological Station from Italy, Portugal and the United States. Large numbers of these insects were bred in cages and some 1000 individuals in different stages of development were placed in boxes or metallic tubes with fairly large holes and hung on various plants (Aurantiaceae and ornamental shrubs) attacked by the scales towards the 15th of August.

By the end of September they had become acclimatized. At the end of 1912 they had spread over all the infected trees, and in the garden in which the first batch had been distributed the scale was entirely destroyed. The development of both insects was arrested during the winter. In the following spring the scale insect broke out again. Fresh colonies of the ladybirds were distributed and in July and August they had so reduced the scale insects as to be short of food. However, a sufficient number survived to check a fresh outbreak of the scale in the early part of October.

The writer considers that this scale is now completely under control in the South of France owing to the acclimatization of *Novius cardinalis*.

INSECTS INJURIOUS TO VARIOUS CROPS.

86 - **Injurious Insects and Other Animals observed in Ireland during the Year 1912.** - CARPENTER, GEORGE H. in *Economic Proceedings of the Royal Dublin Society*, Vol. II, No. 6, pp. 79-104, figs. 1-9, plates X-XI. Dublin, 1913.

The writer gives an account of insects observed as injurious to crops and forest trees in Ireland in 1912.

(1) See No. 1308, *B.* Nov. 1913. *(Ed.)*.
(2) See No. 621, *B.* May 1913; No. 891, *B.* July 1913; Nos. 1010 and 1013, *B.* Aug. 1913.
(3) See No. 891, *B.* July 1913. *(Ed.)*.

87 - **The Serpentine Leaf-miner (*Agromyza pusilla*) injurious to Alfalfa and Other Crops in the United States.** - WEBSTER, F. M. and PARKS, T. H. in *The Journal of Agricultural Research*, Vol. I, No. 1, pp. 59-88, figs. 1-17, plate 5. Washington, October 1913.

Agromyza pusilla is a minute yellow and black fly and was described in 1830 as occurring in Central Europe, but without definite locality or host plant. The habits of the larvae of this insect, as leaf-miners of clover, have long been known both in Europe and America. With the rapid increase of alfalfa culture in the United States, especially in the irrigated sections of the West, the damage of this insect amongst forage crops has been more frequently brought to the attention of the Bureau of Entomology and it has been the subject of investigations by several members of the Section of Cereal and Forage Crop Insect Investigations during three years.

As a result of recent research, the following species are considered synonymous with *A. pusilla*: *A. pumila* Meig., *A. strigata* Meig., *A. exilis* Meig., *A. amoena* Meig., *A. puella* Meig., *A. pusio* Meig., *A. orbona* Meig., *A. blanda* Meig., *A. diminuta* Walker (?), *Oscinis trifolii* Burg., *Oscinis brassicae* Riley.

It is generally distributed throughout the United States, having a wide range of food-plants. It also occurs in Europe, but on fewer host-plants. In the larval state it is commonly found in alfalfa fields during the summer. The larvae injure the foliage of the plant by burrowing between the membranes of the leaf and devouring the parenchyma. The injury takes the form of a serpentine mine which encircles the leaf, gradually widening as the larva increases in size. Leaves of white clover and frequently of young alfalfa often have the entire cellular tissue devoured, leaving only the two membranes. Usually only one larva is present in each leaf.

The injury from this insect is greatest in the south-west, where the discoloured leaves, which in severe cases become brown, are sometimes present in sufficient mumbers to lower the quality and grade of the hay. The injured leaves can be found in the fields from May until November, the larvae continuing to feed until killed by frost. In Florida the larvae continue feeding throughout the winter.

The insect hibernates in the puparia beneath the surface of the soil at the base of the plants. In latitude 40° there are five or six generations, and the number varies with the length of the growing season. Generations overlap to such an extent that all stages can be found in the fields during most of the summer.

During the hottest part of the summer the larvae are usually found in those plants protected from the direct rays of the sun, and in the arid south-west the insect almost completely disappears from the fields during this period, reappearing again in September.

The eggs are deposited in the leaf tissue and inserted in punctures identical with those made by the adult in feeding. The period of incubation during June is about four days. The larval period lasts the same length of time, during which the larvae confine themselves to one leaf each and feed day and night. In the Eastern States pupation occurs entirely in the soil, while in the arid Western States it usually takes place in the

larval chambers of the leaf, and is of ten days' duration in June. Thus the average period of the complete life cycle is 23 days.

Besides alfalfa, the following field crops are subject to attack: clover, cowpeas, rape and cotton.

Other species of *Agromyza* have similar habits and are easily confused, *viz. A. angulata* Loew, *A. coquilletti* Malloch, *A. virens* Loew and *A. melampyga* var. *marginalis* Malloch, well-known parasites of timothy, wheat, oats and grasses. In these attacks the mine usually extends the entire width of the leaf and may kill the plant if it is very young.

The larvae and pupae are liable to the attack of numerous parasitic insects, which are highly efficient in keeping the pest under control; but these parasites are less numerous on the approach of cool weather. They are as follows: *Diaulinus begini* Ashm., *D. websteri* Cwfd., *Chrysocharis ainsliei* Cwfd., *C. parksi* Cwfd., *Derostenus arizonensis* Cwfd., *D. diastatae* How., *D. punctiventris* Cwfd., *D. pictipes* Cwfd., *D. varipes* Cwfd., *Daulinopsis callichroma* Cwfd., *Daulinopsis* sp., *Cirrospilus flavoviridis* Cwfd., *Cirrospilus* sp., *Zagrammosoma multiplicata* Ashm., *Closterocerus utahensis* Cwfd., *Pleurotropis rugosithorax* Cwfd., *Eucoila hunteri* Cwfd., *Sympiesis* sp. (?), *Pteromalus* sp., *Opius agromyzae* Vier., *O. aridus* Gahan, *O. brunneipes* Gahan, *O. suturalis* Gahan, *Triphleps* sp. and *Erythraeus* sp.

Many of them are very widely distributed and attack more than one species of leaf-miner.

Frequent cutting of alfalfa kills the larvae in the leaves and does much to protect this crop. This method should be followed where the injury becomes serious. Deep autumn or winter ploughing is advocated for annual forage crops and cereals, in order to bury deeply the hibernating puparia located near the surface of the ground.

88 - **The Metallic Flea Beetle *(Haltica pagana)*, a New Pest of Strawberries in Victoria (Australia).** — FRENCH C. (Jun.) in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XI, Part 10, p. 591. Melbourne, October 1913.

Recently the strawberry crops in the districts of Wandin and Evelyn have been seriously damaged by swarms of insects which made numerous small holes on the leaves and young buds, causing them to wither. This insect has been identified by the writer as *Haltica pagana*, an indigenous beetle formerly feeding on two other Rosaceous plants, *viz. Acaena ovina* and *A. Sanguisorbae* or "sheep burrs".

This is an additional example of an indigenous insect leaving its natural host and attacking an introduced plant. The writer issues a warning of the dangers of the insect to other rosaceous crops (apples, pears, plums, etc.).

Arsenate of lead is an effective remedy, but cannot be used when the plants are bearing fruit. Kerosene oil or benzole might be used to prevent an attack and the insects may be caught in quantities by shaking the plants over tarred boards.

INJURIOUS VERTEBRATES.

INJURIOUS VERTEBRATES.

89 — **The Control of Voles in the Val di Chiana, Italy.** — PASSERINI, N. and MARCHI, C. in *Atti della Reale Accademia economico-agraria dei Georgofili di Firenze*, Series 5, Vol. X, Part 4, pp. 363-367, 1 fig. Florence, 1913.

In the autumn of 1912, after the ploughing-up of some grassland for wheat, so many voles appeared as to endanger the crop. Experiments were made on voles in captivity by feeding them on maize poisoned with white arsenic, sodium arsenite or zinc phosphide (1); the latter substance was the most effective and was preferred in spite of its cost, a mixture containing 1 per cent. being sufficient to destroy the vermin within 4 or 5 hours.

To avoid poisoning fowls, the mixture was placed between two tiles bound crosswise by pieces of wire. This method gave very good results, as dead voles soon began to be found in the fields; on digging into the burrows, many more were found, as many as 20 in a single burrow. The treatment was extended and the voles entirely exterminated. This method is very economical, since the traps are protected from rain; in this case they were left in position from November to March.

A larger number of traps was placed in the badly infested region, and they were moved from place to place as the voles were destroyed. Each trap may serve for about 500 square yards, and the total cost does not exceed 1*s* 6*d* per acre.

The dead voles on the surface of the fields attracted large numbers of kestrels, which devoured them leaving only the head and digestive apparatus.

(1) See also No. 329, *B.* March 1913. (*Ed.*).

ALFREDO RUGGERI, *Gerente responsabile.*

INTERNATIONAL INSTITUTE OF AGRICULTURE

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CONTENTS

FIRST PART: ORIGINAL ARTICLES

SECOND PART: ABSTRACTS

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

II. — CROPS AND CULTIVATION.

a) GENERAL

b) SPECIAL

III. — LIVE STOCK AND BREEDING

a) GENERAL.

PLANT DISEASES.

I. — GENERAL INFORMATION.

III. — BACTERIAL AND FUNGOID DISEASES.

a) GENERAL

b) SPECIAL

IV. — PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

V. — INSECT PESTS.

a) GENERAL

b) SPECIAL

The Bureau assumes no responsibility with regard to the opinions and the results of experimente outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.

ORIGINAL ARTICLES

Composition and Agricultural Value of the Arable Lands in the Argentine Republic.

Part II: Provinces of Cordoba, San Luis, Mendoza, San Juan and Santiago del Estero, and National Territory of the Central Pampa.

by

P. LAVENIR,

at the Ministry of Agriculture, Argentine Republic.

Province of Cordoba. — Bordering on the west the southern part of the province of Santa Fé and the northern part of the province of Buenos Aires, there is a vast extent of plains belonging to the province of Cordoba, which is in reality the continuation of that which forms the two neighbouring provinces already described; that is to say that in the province of Cordoba in the neighbourhood of the two above-mentioned provinces the same kinds of soil are found. They are in fact loams, sometimes rather heavy; further off they become sandy and this latter character prevails in the whole of the south of this province.

The total area of the province of Cordoba is estimated at 42 000 000 acres, while the plain extends for about 24 700 000 acres; the rest is taken up by the mountain masses of the north-west and some salt areas in the north.

In the part adjoining the provinces of Santa Fé and Buenos Aires, on an area including about 12 000 000 acres, it may be said that at present about one-quarter is under wheat and maize; oats are not much grown and only 346 000 acres are sown to flax. We give in Table IV the analyses of some of the good soils of this part of the province of Corboba.

The tenacity of the subsoil is inferior to that in the provinces of Santa Fé and Buenos Aires, and it diminishes still further in the part adjoining the latter province. The impermeable layer of "tosca" exists also in the whole of this plain, but in the eastern belt it occurs at a good depth (26 to

TABLE IV. — *Analyses of Soils. Province of Cordoba.*

	I		II		III		IV	
	S Light brown	S' Yellow-brown	S Yellow-brown	S' Yellow	S Yellow-brown	S' Yellow.	S Yellow-gray	S' Yellow-gray
Fine gravel . . . . %	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	19.70	22.30	44.10	47.20	3.40	1.70	75.40	746.0
Fine sand . . . . . . »	69.60	66.00	45.50	43.70	82.80	78.20	19.80	210.0
Total sand. . . . . . »	89.30	88.30	89.60	90.90	86.20	79.90	95.20	95.60
Clay . . . . »	6.90	10.20	7.50	6.50	11.50	17.20	3.30	3.60
Humus . . . . »	1.00	0.20	0.90	0.40	0.90	0.50	0.20	0.20
Organic detritus and soluble matter. . »	2.80	1.30	2.00	2.20	1.40	2.40	1.30	0.60
Nitrogen . . . . . ‰	1.46	0.62	1.37	0.76	1.53	0.95	0.63	0.69
Total lime (CaO) . . »	7.92	8.46	9.66	10.42	7.03	7.92	8.29	8.74
Soluble lime . . . . »	3.14	2.80	3.81	3.53	3.08	3.53	2.69	3.14
Potash (K_2O) . . . . »	5.74	4.32	5.98	5.51	6.82	8.64	3.80	4.10
Phosphoric acid . . »	1.39	0.97	1.27	1.18	1.78	1.52	1.03	1.03

Analyses: Nos. I, II: Eastern belt; No. III: South-Eastern belt; No. IV: Southern belt.
S = Soil; S' = Subsoil.

50 feet); in the low-lying parts it comes nearer to the surface and even sometimes crops out, holding up the water of more or less important lagoons, all of them brackish.

In the higher soils, where the impermeable "tosca" bed is at some depth, the river water accumulating upon it forms an underground sheet of water, which keeps the overlying ground in a state of permanent humidity very favourable to the development of plants possessing deep roots and especially lucerne; consequently this forage plants covers considerable extents of land (3 700 000 acres in the whole province).

The soil is of medium tenacity or light, and therefore very easy to till; it would dry out easily if it were not for the humus which it contains in large quantities, and which both increases the cohesion and helps to hold a certain amount of moisture. With a nitrogen content sometimes above 2.50 per 1000, these soils are very rich in potash and have also a high phosphoric acid content; the lime content is low, exceeding 10 per 1000 only towards the mountains. These are very fertile soils, suitable for all crops.

In the rest of this plain, which is about 13 000 000 acres in extent and extends throughout the south of the province of Cordoba, the soil is generally sandy; soils with 10 per cent. of clay are rare, 7 per cent. being an average, and in many cases it is as low as 3 per cent. The moisture in the subsoil, due to the presence of the water table at a slight depth, already mentioned

above as existing in the east of this province, continues to appear on a vast area on both sides of the Pacific railroad which crosses the southern part of the province approximately from east to west. On travelling by this line, one is surprised to see the enormous extent, often as far as the eye can reach, occupied by lucerne and interrupted by wheat and maize, the two latter together occupying an area of about 3 500 000 acres.

From the above it will be seen that this is a region whose future lies in mixed farming: breeding and dairying with cultivation of wheat and flax, the latter prevailing on the heavier land towards the east, while on the west and especially to the south stock breeding will prevail on account of the lightness of the soil. In the whole of this plain fruit-growing gives excellent results.

A good deal might be said on the soils of the mountain region of this province, an important part of which is still covered by forests ; these are exploited in some localities, near means of communication, for charcoal and for fence-posts ; there are also considerable areas under cultivation. Some of these lands are irrigated, but a great deal more might be done by suitable works which would allow the numerous watercourses descending from the mountains to be utilized. In general the soils are fairly calcareous. Fruit does remarkally well, both for quantity and quality; vines also thrive in these soils, which are indeed suitable for a number of crops, especially lucerne.

National Territory of the Central Pampa. — To the west of the province of Buenos Aires and to the south of that of Corboba lies the territory of the Central Pampa, which is a continuation of the plains described above, with soils similar to those of the neighbouring provinces ; in general they are light and sandy, somewhat heavier in the part near the province of Buenos Aires ; in the southern part, however, they are very sandy and often shifting.

This vast territory, extending over 36 million acres, bears cereals on about 2 ½ million, chiefly on the land in the east and north-east which presents more cohesion, but the full extent of the acreage which might be brought under cultivation is still difficult to estimate. The rest of this territory is almost all uncultivated ; it is studded with numerous clumps of Algaroba trees (*Prosopis Algarobilla*) occupying areas of varying extent. Towards the west there are many salt soils ; indeed this western half of the plain is within the arid belt of 200 mm. (8 inches) of yearly rainfall, in which agriculture would not be possible without the aid of irrigation ; as fresh water, both superficial and subterranean, is completely lacking, it is a region in which agriculture has a very limited future, and which is hardly suitable even for sheep breeding.

The other half of the Pampa gets from 200 to 400 mm. (8 to 16 inches) of rainfall and only the north-eastern corner, that is, one of the parts that we have mentioned as the most fertile, is within the belt of 600 to 800 mm. (24 to 32 inches) which embraces all the south-west of the province of Buenos Aires and almost the whole of that of Cordoba. In this north-eastern section, and perhaps also in other localities situated in the eastern

TABLE V. — *Analyses of Soils. Pampa Territory.*

	I	II		III		IV		V	VI	
	S Light brown	S Brown	S' Light brown	S Yellowish brown	S' Yellowish brown	S Brown	S' Brown	S Gray	S Yellowish brown	S' Yellowis brown
Fine gravel . . . . %	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . »	62.20	24.10	30.70	33.40	32.80	57.10	59.40	76.10	81.00	79.50
Fine sand . . . . »	27.20	66.00	59.80	54.33	56.22	37.23	35.59	17.80	16.19	16.94
Total sand . . . »	89.40	90.10	90.50	87.73	89.02	94.33	94.99	93.90	97.19	96.44
Clay. . . . . »	7.70	8.00	8.30	10.30	8.60	4.00	3.90	2.94	2.20	2.80
Humus . . . . »	0.70	1.30	0.60	0.60	0.60	0.50	0.30	1.00	0.10	0.10
Organic detritus and soluble matter . . »	2.20	0.60	0.60	1.37	1.78	1.17	0.81	2.76	0.51	0.66
Nitrogen . . . . ‰	1.91	1.50	0.70	1.09	0.91	1.23	0.52	0.52	0.38	0.32
Total lime (CaO) . . . . »	7.96	10.66	10.44	12.77	17.47	16.86	25.77	12.71	9.38	11.31
Soluble lime . . . . »	3.53	5.04	4.69	5.81	10.22	7.98	16.73	5.68	2.73	3.57
Potash (K_2O) . . . . »	4.48	6.15	6.32	3.67	3.74	3.77	3.40	3.08	2.21	2.35
Phosphoric acid . . . . »	1.52	1.69	1.30	1.49	1.24	1.28	1.05	1.11	1.09	1.07

Analyses: Nos. I, II, III: North-eastern and eastern region; No. IV: Central region; Nos. V, VI: Western region. — S = Soil; S' = Subsoil.

half of the Pampa, the judicious application of dry-farming methods on the less sandy soils might yield some results, but they ought to be combined with natural wind-breaks (such as rows of trees) in order to diminish as far as possible the violence of the prevailing dry winds and the excessive evaporation which they cause in these very loose soils; the windbreaks would also prevent within certain limits the blowing away of these soils so wanting in cohesion and kept loose by the repeated tilling which forms the basis of this system. Up to the present no experiment has been made to throw light on this interesting subject.

In the subsoil of the Pampa the layer of "tosca" also occurs as in the neighbouring provinces, but in general only at a slight depth, which also contributes to render farming often problematical even in the best parts (1). Table V shows analyses of soils from this territory.

Province of San Luis. — The characters of the western half of the Pampa territory prevail in the southern part of the province which borders it to the north, namely San Luis, and on an area which may be roughly estimated at 2 ½ million acres. This province, the total area of which is 18 258 000 acres, is situated to the west of the province of Cordoba; in the centre of the northern part there is an important group of mountains separated from the above-mentioned province by a broad valley which in its turn is limited on the east by the Sierra de Cordoba running north and south and marking the boundary between the two provinces. This valley is furrowed by numerous small streams descending from the neighbouring mountains; it offers to farming, or rather to stock breeding, an area of about 500 000 acres; to this may be added an extension towards the south as far as the Rio Quinto, which starts from the south end of the mountains and flows in a south-easterly direction to lose itself in the south of the province of Cordoba; the whole area amounts to 1 250 000 acres.

The soils of this plain are somewhat different from those hitherto described (see Table VI). They are for the most part light and very permeable, with a rather high lime content, sometimes reaching 50 per thousand; they all contain small quantities of gypsum and are rich in potash, well provided with phosphoric acid and frequently fairly rich in nitrogen. They rest on a subsoil very nearly resembling the soil, and the content of sand increases with the depth until the water-table is reached. This is situated at a variable depth below the surface, but often sufficiently near it to be able to keep the subsoil moist, which greatly favours vegetation. Where sufficiently moist, these soils are excellent for Leguminosae in general; lucerne grows luxuriantly and almost indefinitely (2).

Continuing towards the south, but always in the part adjoining the province of Cordoba, the soil becomes more and more sandy with a clay content between 7 and 2 per cent. It is fairly rich in lime, but poor in nitrogen on account of the scanty covering of natural vegetation; nevertheless in some localities and for considerable extents lucerne thrives very well

(1) Nevertheless lucerne is grown on nearly a million acres.

(2) It occupies about 450 000 acres.

TABLE VI. — *Analyses of Soils. Province of San Luis.*

		I		II		III		IV	
		S Yellow-brown	S' Yellow-brown	S Gray	S' Gray	S Yellow-gray	S' Yellow-gray	S Reddish gray	S' Reddish gray
Fine gravel	%	0	0	0	0	0	0	0	0
Coarse sand	»	38.20	37.70	50.10	49.90	53.50	50.40	77.50	82.70
Fine sand	»	48.00	49.04	38.10	39.60	34.60	37.10	19.30	14.54
Total sand	»	86.20	86.74	88.20	89.50	88.10	87.50	96.80	97.24
Clay	»	11.50	11.10	9.00	7.60	8.90	9.10	2.40	1.40
Humus	»	0.90	0.60	0.90	0.50	0.70	0.70	0.10	traces
Organic detritus and soluble matter	»	1.40	1.56	1.90	2.40	2.30	2.70	0.70	1.36
Nitrogen	‰	1.71	0.98	1.32	0.87	1.45	1.44	0.56	0.41
Total lime (CaO)	»	10.89	15.68	13.47	22.79	22.09	25.26	10.39	10.02
Soluble lime	»	5.60	9.80	11.34	18.82	16.80	19.94	1.68	1.33
Potash (K_2O)	»	9.06	8.74	8.00	7.10	8.08	8.64	2.99	2.89
Phosphoric acid	»	1.62	1.49	1.59	1.54	1.69	1.73	1.15	1.34

Analyses: Nos. I, II: North-eastern region; No. III: Eastern region; No. IV: South-eastern region
S = Soil; S' = Subsoil.

owing to the moisture of the subsoil, due as in the northern part to the proximity of but slightly saline subterranean water.

This eastern part of the province of San Luis, bordering on that of Cordoba, is about 3 450 000 acres in extent; with the plain described above, this makes a total area of 4 700 000 acres, all of which is situated in the rainfall belt of 400 to 600 mm. (16 to 24 inches); but owing to the extreme permeability of the soil and the prevalence of drying winds, the soil soon dries out, so that plants suffer from drought in the non-irrigable parts, which are by far the more extensive. These dry areas are often covered by stunted shrubs (chañares, *Gourlica decorticans*) which protect the sparse and tough grass which grows there against the scorching sun; in these poor pastures sheep are bred, while in the moister lands provided with more abundant vegetation cattle and mules are grazed.

In the mountainous region, an important extent of which is wooded, there are also some very good soils and fertile valleys in which irrigation is possible; the atmospheric precipitations are more abundant than in the neighbouring plains, and consequently vegetation is more vigorous.

All the belt to the west and south-west of the mountain ranges is arid and partly saline; the want of fresh water renders any attempt at farming impossible, especially as the climate is still drier than that of the east of this province.

Province of Mendoza. — Continuing still towards the west one enters the province of Mendoza, separated from that of San Luis by the Rio Desaguadero flowing almost due south. The waters of this river are unfortunately salt and unsuitable for irrigation or for watering live stock. This province has an area estimated at 36 160 000 acres, but notwithstanding the good quality of the soil which forms the plain stretching from the above river to the foot of the Andes, only a small proportion of its acreage is under cultivation; this is due to the extremely dry climate, which does not allow of any farming without permanent irrigation. The western part of this province is occupied by the chain of the Andes up to the summits, which form the frontier between Argentina and Chile; all this mountainous part is arid with the exception of an occasional unimportant valley watered by a stream and used as pasture for stock; the rest is absolutely bare of vegetation. From the immense glaciers of the Cordillera descend numerous torrents, which combine before issuing into the plain to form several important rivers; the largest of these is the Rio Mendoza, whose waters, particularly abundant during the hot season, are to a great extent utilized for irrigation, supplying most of the land at present cultivated in the province.

In the plain bordering the Rio Desaguadero, which extends for a breadth of sixty to seventy miles, there is no cultivation except on a strip reaching across the province on each side of the Pacific railway, where the waters of the rivers Mendoza and Tunnuyan are made use of.

In this plain the soil is sufficiently calcareous, and contains also considerable quantities of gypsum; it is well provided with other elements of fertility except nitrogen, which is deficient on account of the scantiness of the natural plant covering. The soil, 8 to 10 inches deep, is generally loamy, but sometimes sandy; the subsoil is almost always more sandy and at a greater depth becomes pure sand, which in its turn rests on a stratum of rolled pebbles of considerable thickness. Over such a permeable formation, the volume of the streams descending from the Andes naturally diminishes rapidly, and they completely lose themselves at a relatively short distance from the Cordillera; this circumstance greatly reduces the importance of the irrigable belt. Like the adjoining country of San Luis, this vast plain is partly covered by shrubs (chañares); it contains also, especially towards the north, considerable saline areas.

In the portion near the Pacific railroad, water is found at a small depth (15 to 30 feet), but it is almost always more or less brackish. As the town of Mendoza is approached, following the same railway line, the character of the soil changes sensibly; there is a large extent of alluvial deposits of a rather calcareous nature, generally more so than those forming the plain; the soil is also more compact, being somewhat heavy, or at any rate loamy, with a clay content attaining 10 to 15 per cent.; this land is permeable and easily cultivated. The depth of soil varies between 12 and 32 inches; the subsoil is more sandy and often rests on gravels, under which, as in the plain, there is a pebble bed of great thickness. (See Table VII).

TABLE VII. — *Analyses of Soils. Province of Mendoza.*

	I		II		III		IV		V		VI
	S Ye owish gray	S' Yellowish gray	S Yellowish gray	S' Yellowish gray	S Yellowish gray	S' Yellowish gray	S Reddish gray	S' Reddish gray	S Yellowish gray	S' Yellowish gray	S Gray
Fine gravel . . . . %	0	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . »	51.51	58.56	70.88	55.39	63.45	76.81	61.85	75.51	81.25	83.86	75.40
Fine sand . . . . »	34.07	29.04	18.28	30.58	29.58	18.96	28.50	16.10	13.30	11.75	21.72
Total sand . . . . »	85.58	87.60	89.16	85.97	93.03	95.77	89.35	91.61	94.55	95.61	97.12
Clay . . . . »	12.20	10.82	8.40	11.55	4.28	2.50	8.21	6.00	2.96	2.72	2.20
Humus . . . . »	0.15	traces	0.20	0.15	0.50	0.50	0.20	0.10	traces	traces	0.10
Org. detritus and soluble matter »	2.07	1.58	2.24	2.33	2.19	1.23	2.24	2.29	2.49	1.67	0.68
Nitrogen . . . . ‰	1.05	0.84	0.70	0.56	1.40	0.60	1.81	0.49	0.30	0.24	0.36
Total lime (CaO) . . . . »	41.21	31.19	45.58	33.54	25.14	25.20	13.61	12.18	20.72	22.79	22,45
Soluble lime . . . . »	25.10	20.23	26.13	19.60	18.30	17.42	6.58	10.86	14.56	16.73	6.79
Potash (K_2O) . . . . »	5.34	5.32	4.28	4.95	4.32	3.98	3.65	3.92	3.46	3.86	5.72
Phosphoric acid . . . . . »	1.92	1.76	1.83	1.96	1.73	1.34	2.02	1.60	1.46	1.34	1.65

Analyses Nos. I, II, III : Vineyards; Nos. IV, V, VI: Cordillera foothills. — S = Soil; S' = Subsoil.

Vine growing is extraordinarily developed in this province, where the conditions are extremely favourable to it. Soil and subsoil suit the vines perfectly and these give high yields without manuring. The average yield is 4 to 5 and even 8 tons per acre, and what is very important the dry climate protects the vines against the attacks of fungus diseases. It is the most important vine-growing centre of the country ; at present it embraces about 150 000 acres (1) of vineyards, of which about two-thirds are situated on the alluvial land described above ; this part is irrigated by water from the Rio Mendoza.

Further south, but still following the foothills, the soils become gradually more sandy, and are cultivated only where irrigation is possible ; they bear vineyards, fields of lucerne (2) and grassland devoted to breeding and to the keeping of the mules and horses required for the wine industry.

During the last few years fruit growing has made a vigorous start and tends to develop from year to year ; olives especially give good results. This is a region with a great future before it; its cultivable area cannot be estimated at present, as it depends upon the irrigation works to be made, both in completion of those at present existing and to tap the other streams running into it. Some important colonies have been lately founded and they are all prosperous. Fruit growing is mostly practised and also sylviculture, while important works are being carried out with the object of increasing the irrigable acreage.

Province of San Juan. — Conditions of climate and soil closely resembling those described above are met with in the neighbouring province of San Juan, situated to the north of the province of Mendoza. The area of this province is estimated at 21 563 000 acres, but it is very mountainous ; its soil in general is sandy and its subsoil very permeable, so that no cultivation is possible without irrigation. Only the bottoms of some valleys favoured by the presence of streams are cultivated ; unfortunately these watercourses are of no great importance, except of course the Rio San Juan passing by the town of that name, situated in the south of the province and like Mendoza near the Cordillera.

It is thus in a belt of relatively small extent round the town that most of the cultivated land lies ; this is especially given up to vineyards, which, while they do not cover an area as extensive as those of the province of Mendoza, yet follow them immediately in point of importance in the whole country.

These vineyards occupy an area of 75 000 acres ; they produce wine and raisins. Fruit growing is also beginning, but it does not seem destined to develop to the same extent as in the neighbouring province of Mendoza On the whole it is not a very populated region, but one which tends to improve considerably from an agricultural point of view within the area capable of irrigation, which will always be relatively restricted, owing to

(1) In 1887 the area of the vineyards was 11 660 acres; in 1909 it reached 74 630 acres, and at present it is 150 000 acres, which yield about 88 million gallons of wine.

(2) In this province 230 000 acres are under lucerne.

the small amount of available water; further the extreme permeability of the soil and subsoil necessitates abundant and frequent watering (1).

Province of Santiago del Estero. — Lastly, in order to complete the description of the immense plain which forms the most important part of the Argentine from an agricultural point of view, there remains to be mentioned the province of Santiago del Estero, situated to the west of the province of Santa Fé and to the north of that of Cordoba. It is a considerable extent of plains (35 250 000 acres), traversed by a few watercourses, of which the two most important, the Salado and the Dulce or Saladillo, run parallel to each other towards the south-east.

In the whole province the only interesting part is that lying between these two rivers or near them. In the south-west are enormous salt deposits and salt lands, and the same occurs also in the north-east; they are almost desert, on account of the want of fresh water on the surface and in the depths of the soil. The climate of this province is dry and the scanty rains fall during the summer from the end of November to the beginning of May, when the temperature is often excessively high.

The arable land of the part mentioned above as the best, consists for the most part of deep, light or loamy, sometimes somewhat heavy soils; the subsoil does not differ much from the surface soil. The composition varies from place to place: in the more humid parts occur soils rich in humus and nitrogen; their lime content is frequently high (10 to 50 per 1000 and sometimes even more), but a singular and general feature is their richness in potash, which is rarely below 5 per 1000 and reaches as much as 12 per 1000, while in many soils it is between 8 and 10 per 1000; it is the same with phosphoric acid, which rarely falls below 1 per 1000 and attains 3 per 1000, in many cases ranging between 1.50 and 2.35 per 1000.

This region is thus not without some very interesting soils, but it is impossible at present to estimate their extent; they are unfortunately intermingled with more or less salty areas which would require a special treatment to eliminate the excess of soluble salts they contain; this would be possible only by means of irrigation. It is in this connection that the difficulty arises, since the waters of the two rivers, the only available ones, are rather unsuitable for this purpose, throughout the whole of their course; they gradually get charged with chloride and sulphate of soda, of which salts they already contain a certain quantity on entering the province;

(1) In spite of this there are already 136 000 acres of lucerne.

The Testing of Calculation according to Kellner's Starch-Values in Practical Feeding in Germany

BY

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Calculation according to starch-values had its origin in Germany and the method is less known to the agriculturists of other countries, for which reason I will first give a brief account of the principles of this system of calculation.

The important bearing of the laws of energy upon the physiology of nutrition was recognized from the results obtained by RUBNER in Berlin and ATWATER in the United States, and was also confirmed by other investigators. Further, O. KELLNER followed in an admirable manner the transmutation of energy which takes place during the assimilation of food by farm animals, especially in the case of oxen during fattening. N. ZUNTZ and his fellow workers have turned their attention to the relation existing between food energy and the amount of work done by horses.

Animals take up chemical energy with their food. Those portions are useless which pass through the intestines and are ejected, as are also the substances which are removed by the urine in the form of incompletely decomposed organic compounds. We may designate as "gross energy" the total energy content of the food minus the energy content of the excreta, the urine and the intestinal gases. In order to obtain the "net energy" from the "gross energy" it is necessary to make several deductions from the former, in particular for the work of chewing and digestion, including the mechanical work of taking in nutritive substances, and impelling indigestible substances through the digestive canal. In the case of ruminants, in which this is of especial importance, the chief loss is caused by the crude fibre of the food; for each kilogram of crude fibre eaten, an expenditure of 1360 calories is necessary on an average; and the energy content of the digested portion of the food is decreased by this amount. The net energy is used by the animal in the maintenance of life, especially in the movements of the heart, lungs and the various body muscles, as well as for the conversion of vegetable food into animal substance, *viz.* the transformation of carbohydrates into fat, and of protein into flesh, blood, milk, etc. Part of the net energy is also made use of by the bacteria living in the intestines and the rumen.

Whatever net energy remains to be of practical use to the agriculturist, we call "stored energy", *i. e.* all the energy which is laid up in the form of flesh, fat, glycogen, etc. Milk can also be reckoned in, for as is

well known, this is made from certain substances taken up by the small glandular cells of the udder (with the assistance of the nerves) from the blood and the lymphatic vessels, and which temporarily serve to build up the gland cells.

The work of science is to ascertain how much of the gross energy of the food passes over into "stored energy". In this direction, O. KELLNER has done prominent work as regards the fattening of adult ruminants. He was doubtful as to the best word to be chosen for the use of the practical farmer to express the ascertained "stored energy". The educated farmer knows the meaning of starch, fat, protein, etc., but Kellner considered that the term "stored energy" ("Ansatz-energie") would be beyond his comprehension and chose another way of expressing the idea.

In fattening, fat is made from starch, about 2360 energy values (calories) being stored up in the body for every kilogram of starch taken in. Kellner took the number 2360 as a unit, called it=1, and gave it the name of "starch-value".

The amount of energy derived from protein, fat, sugar, etc., and stored up in the body can be referred to this unit, and in this manner the starch-values of the various other nutritive substances and feeds can be calculated. For instance, 1 kg. of digestible protein has in fattening a starch value of 0.94, and 1 kg. of fat in oil-cakes has a starch value of 2.41.

M. RUBNER had already ascertained that digestible food stuffs are isodynamic, and that every foodstuff can be reduced to a unitary basis by calculating the energy value (calories). Further, it is necessary to pay attention to the amount of the digestible protein, for this cannot be replaced by fat and carbohydrates. In addition to ascertaining the starch-value ("Ansatz-energie"), it is thus necessary to be sure that a certain amount of the starch-value exists in the food in the form of protein.

a) *Fattening with regard to starch value.*

A number of fattening experiments with oxen and pigs were carried out under the conditions obtaining in practical farming, definite numbers of starch values being fed. Oxen were undertaken by G. ANDRAE at Braunsdorf and W. SCHNEIDEWIND at Lauchstädt. Pigs were dealt with by J. HANSEN, W, SCHNEIDEWIND, THIELSCH and others. The reports showed without exception that the rations determined according to Kellner's starch values were correct, and that this method of reckoning the amount of food required was preferable to all other systems.

This practice will become more general in Germany in the future than it has been hitherto.

b) *Feeding of milch cows with regard to the starch value of the feed.*

Of late years, the Control Associations have taken a leading position in Germany respecting the feeding of milch-cows, as far as the application of scientific experience to practical methods of agriculture is concerned. Some of these Associations calculate according to starch-values and others according to "food units". The last-named method was adopted from Denmark and Sweden, and is based on the work of FJORD and FRIES in Copenhagen; these workers ascertained that a milch-cow must consume 1

kilogram of rye, rye bran or wheat bran, in order to produce 3 kilograms of milk. Forother feeding-stuffs similar results were worked out, giving substitution-figures for rye etc.; the amount which was equivalent to 1 kg. of rye was called a " food unit ". The amount of many foods which constites a food unit has since been altered as a result of practical experience, especially after Kellner made known the starch-values. The differences between starch values and food units have now been adjusted. The value relation is: 1 food unit = 0.605 starch-value = 1430 " stored energies ". There is therefore no reason to retain in future the term food unit (which was only used in one part of Germany). For my part, I should suggest that in the different feeding systems the number of " stored energies " should be internationally substituted for starch values (which were introduced for calculating the increase in fat during the fattening process).

Most of the Control Associations in Germany reckon according to starch values. Further, numerous feeding experiments under the conditions of farming practice have been carried out on the basis of starch-values, *viz.* those of J. Hansen, G. Andrae, Thielsch, von Knieriem and Buschmann, Morgen, Beger, Westhauser. All agree that reckoning starch-values (" Ansatz-energien ") is far more satisfactory than the old method of calculating from digestible food materials.

Those practical farmers in Germany who carry out such calculations, make use of starch-values or food units; they reckon therefore, though for the most part unconsciously, according to stored energies, since these three methods of calculation are comparable with temperature returns on the Réaumur, Fahrenheit and centigrade scales. The figures given are different, but the same amount of heat is expressed; in our case, the amount of energy is equal, but the figures are different.

With regard to the feeding of milch-cows, there is still a difference of opinion as to what proportion of the starch-values mustbe given in the form of digestible protein.

Formerly Wolff nd Märcker reckoned that a cow must consume 90 gms. of digestible protein to produce 1kg. of milk. Kellner in 1905 reckoned the amount at from 60 to 75 gms., and from 1906 at only 45 to 57.5 gms., the smaller amount in the case of lower, and the greater in that of higher, milk yield. The Swedish, Danish and Schleswig Control Associations calculate, according to the proposal of Nils Hansson, 45 gms. of digestible protein for every kg. of milk, without any regard to the amount of milk produced. Each cow receives in addition as maintenance ration 325 gms. of digestible protein per 500 kg. of live-weight.

Nils Hansson in Stockholm rightly points out that the experience acquired by Kellner respecting the protein required in fattening cannot be used in the case of milk production, since greater transmutations of substances and energy take place in transforming food protein into flesh or into nitrogen containing connective tissue than in transforming it into the nitrogenous components of milk (1). In the latter case, the molecular

(1) See No. 42, *B.* Jan. 1914. (Ed.)

redistribution is less and the food protein is utilized better. This view coincides with the results obtained by JORDAN at Geneva (New York); he found that when the food contained little protein 90 to 95 per cent. of the quantity over and above that required for the maintenance of the animal was transformed into milk, while with larger quantities of food protein, much less of the latter was used for the purpose of milk production.

According to the wide experience of the Scandinavian Control Associations, it would be highly desirable to diminish the amount of protein prescribed by Kellner, unless any special reason exists for giving a large quantity. From the practical point of view the matter is of importance in that protein is an expensive food material. It must be decided independently of the general question as to whether reckoning according to starch-values has proved satisfactory. This question can, without doubt, be answered in the affirmative for Germany.

Trials of Agricultural Machines in Sweden

by

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HISTORICAL.

The first official trials of agricultural machines made in Sweden were organized by the Royal Academy of Agriculture, which celebrated its centenary in 1913, and by the societies of Rural Economy. The latter, almost all of them founded at the beginning of the nineteenth century, are 26 in number, or one and sometimes two in each province.

The Academy of Agriculture organized in 1874 a trial on a large scale of threshing machines and mowers on the occasion of an agricultural show, but as a rule the machines which competed for prizes in the Swedish General Agricultural Congresses ("Allmanna Svenska Landtbruksmotena") were not submitted to trials. The agricultural congresses, which include the whole country, are held every five years in different parts of the country; at those of 1886, 1891 and 1896 certain groups of machines were tried by means of funds which on each occasion were appropriated by the State for this object.

In proportion as the demand for machines grew and the offer of the Swedish and foreign manufacturers grew still more, it became necessary that in the choice of a machine, the agricultural public should have a more reliable guide than the prize judgment based only upon ocular inspection; hence arose the need of submitting to an exhaustive test the working of every machine exhibited at the Swedish general agricultural shows; for this purpose the establishment of permanent trial stations, working uninterruptedly, became necessary. The manufacturers themselves demanded the institution of these stations with the expectation of obtaining useful information for the work

of construction. As a matter of fact it was in consequence of a donation of 100 000 crowns (£ 5 500) made by one of our largest agricultural machine manufacturers (The Separator Joint Stock Company) that these institutions were started. According to the deed of donation there was to have been one trial station in each of the agricultural institutes of the country: at Ultuna in Central Sweden, exclusively for agricultural machines, and at Alnarp in Southern Sweden for agricultural and dairy machines; the trial of machines in one of these establishments was to be one of the conditions to be fulfilled before they could be exhibited and entered for the prize competitions at the agricultural congresses ; it was calculated that the capital given, with the interest and the fees fixed for the entries to the trials, would have been sufficient for a little over ten years.

The regulations were drawn up in 1897 and when, almost at the time that had been foreseen, the fund was exhausted, the State granted from year to year the necessary sums with which to continue the work. In 1912 the Stations were reorganized. New regulations were introduced at the beginning of 1913, under which the State subvention, which is appropriated only year by year, amounts to 21 000 crowns (£1155).

Organization.

The Trial Stations have a common board of management which deals with all the business of general interest, such as the tariff of fees for the trials, the budget of the work to be done, the nomination of certain members of the trial committees, etc.; but each of the Stations has a special committee which carries out the trials. Originally the director of the Institute and the professor of machine building were *ex officio* members of the commitee, as well as the manager of the Institute's farm or the professor of dairying (for the part concerning dairy machines); besides the above, an engineer and a practical farmer or dairy manager are nominated members of the testing committee. With this system the Stations worked independently of each other, and there was a danger of different principles being followed in judging.. Further, the drawing up of the reports being entrusted to persons whose time was taken up by their regular work, it happened sometimes that the trials as well as the reports concerning them would be put off for a long time. In order to avoid these drawbacks, since the reorganization of 1912 one director has been nominated for the two Stations at a salary which enables him to devote all his time to the trials and to the drawing up of reports. The directors of the institutes do not belong any longer to the committees. An assistant to the director and a mechanic are permanently appointed.

Method of working adopted by the Trial Stations.

The trials include : machines already on the market (in this case the report of the trial must be published, whatever the conclusion may be), and machines under experimentation but not yet offered for sale : in this case

the maker has the right to demand that the results of the trial should not be published. The trials of this class are naturally not so frequent as those of the first, as when a maker has brought a machine to the point of being tried he is usually anxious to begin selling it.

The trials are the following:

a) *Trials in series*, comprising whole classes of machines: they are generally organized every year for one or two classes of machines by the board of the Trial Stations and are free of charge.

b) *Individual trials*, for which a fixed fee is paid, are made at the request of farmers, or the manufacturers or vendors of the machines.

c) *Trials undertaken on the initiative and at the expense of the Trial Committees*; they refer to machines which it appears desirable to make known.

Owing to the great numbers of trials of classes *a*) and *b*), only a few of class *c*) have so far been made.

It is formally stipulated that the machines submitted to trial must not be built differently from or with more care than those of the same type already on the market, and the Committee has the right of selecting in a vendors' store the machine of the type that has been entered for trial.

The person who enters a machine is obliged to be present at the trial, or if unable to attend, he must provide someone to represent him. He may, if he thinks fit, make preliminary trials until the machine is declared ready to be submitted to the trial proper; when a machine is entered by a person other than the maker or his delegate, or when the trial is made on the initiative of the Committee, the maker must, if possible, be informed of the date of the trial, and he has the option of being represented. Besides the parties interested, no one has the right to be present at the trials without the Committeés authorization.

According to the tariff at present in force, the entrance fee, when one is due, is based upon the price of the object tested; it varies from 10 to 75 kroner (11*s* to £4 2*s* 6*d*) according as the price is below 50 kr. (£2 15*s*) or between 750 and 1000 kr. (£41 5*s* and £55); if the price is above £55 the fee is increased by 5 per cent. of the amount above this sum.

The features chiefly considered at the trials and in judging the machine are: *construction, quality of material, make, durability, capacity for work, quality of work done, consumption of power, facility of handling*, as well as the *price* if it deserves notice from some point of view. The question of judging by points has been much discussed and this system has sometimes been followed; but on the one hand it is impossible to determine the relative numbers of points for the various qualities, and on the other hand a high final number, by which a buyer without critical sense might be tempted to be guided, might be the result of qualities which in certain respects are of no importance for some buyers, whilst the machine, for some other quality might not suit them. Thus the verdicts on the machines are given only in words on the points mentioned above and on some others which might have some weight in forming an opinion on the machine, but which would not have any on the final number in the case in which points are given according to a fixed scheme.

In order to judge most of the characters mentioned above, the Trial Stations possess the necessary instruments and tools, especially for measuring the consumption of power; for testing the materials it is often necessary to apply to the material-testing workshop of the Technical College in Stockholm. For the calorific value of fuels, recourse is always had to this College.

In most cases the trials are conducted on the farms of the agricultural institutes, where special constructions have been erected for the Trial Stations and where it is possible, on payment, to have the necessary labour, teams and power. When necessary the trials are made in other localities and not at the Institutes of Alnarp and Ultuna. The makers of the large motors avail themselves more than others of this concession, because for them the trial in their own works, notwithstanding the travelling and other expenses and a higher fee paid to the members of the committee, is cheaper than sending the machines to the Trial Station.

For many machines, further trials, called the long trials, are held after the principal trials in the presence of the Committee are finished. Their object is to demonstrate better the durability and facility of handling in ordinary farming; after these trials, the machines are examined and the manager and the farm hands report their experience of the use of the machine.

PUBLICATION OF THE RESULTS OF THE TRIALS.

Detailed reports of all the trials are drawn up; they include: the *description* of the object tried, the *account of the trial*, and the *judgment*. When several machines of the same class are tried at the same time, as in the trials by series, parallel comparisons, as far as possible in the form of tables, are made of the special characters of the machines and the results of the trials. In cases in which the reports are not to be published, but only communicated to the person who has had the trial made, the description is limited to what is strictly necessary to characterize clearly the machine or implement, so that if the trial is repeated it should be possible to see in what respects its construction has been modified. In the series trials these reports may be completed by a chapter on the group of machines examined, and also by special detailed tables with the results of the comparative trials used as a basis for the judgment, etc.

It is always sought to give the final verdict in a concise form and to draw it up in such a way that the maker can insert it in his prospectus and advertisements. When the Trial Stations learn that a judgment has been published with suppressions, or in such a way as to be misleading, they are bound to have the error publicly rectified.

The reports which are to be published appear in the Bulletin of the Board of the Trial Stations (*Meddelande från Styrelsen för Maskin och Redskapsprofningsanstalterna*). The first of these Bulletins, reporting the trials made in 1898, appeared in 1899; up to September 1913, thirty-six Bulletins have been issued, in which a total of 3352 pages represent the

reports of the trials. Some of the earlier Bulletins were rapidly taken up and are out of print, but reprinting *in extenso* reports on machines some of which are out of date did not seem necessary, and in 1910 a summary of the first ten Bulletins was given in a volume of 300 pages.

Conclusion.

It is beyond discussion that the work of the Trial Stations has been of far-reaching importance for Swedish agriculture and for the Swedish machine industry. The extension of the movement bears ample testimony to its value. The power of the Trial Stations lies in the minuteness of the valuation and in the conscientiousness with which the trials are conducted. If the new organization allows the results of the trials to be more promptly known, a desire frequently expressed by machine builders and vendors will be realized.

A proof of the great importance attached by all to the trials is the fact that when an agent of a manufactory offers an agricultural machine to a merchant, the first question that the latter usually asks is "What is the opinion of the Trial Station"? And if the machine has never been presented to the Stations, the negotiations are generally broken off with the words: "Come again when the machine has been tried". It has often been noted that the largest American firms have taken into consideration the verdicts of the Swedish trials and have introduced into certain machines the modifications suggested by the trials.

Present State of the Dairying Industry in Canada.

by

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Dairy and Cold Storage Commissioner.

According to the census of 1911, these were 2 594 179 cows in Canada that year. This was an increase of 185 502 as compared with the census of 1901. The increase was all in the Western Provinces. In all of the five Provinces east of the Great Lakes there was a small decrease in the number of cows during the decade. The number of the cows, however, is only one of the factors which affect the production of milk, for we find that while the value of the total product in 1900 was $66 470 953 it had risen to $109 340 000 in 1910. In other words the increase in the number of cows during the decade was only 7 per cent., while the increase in the value of the total product was 60 per cent. In Ontario, where there was a decrease of 3 per cent in the number of cows, the value of the product increased by 18 per cent during the same period; in the Province of Quebec, with a decrease of nearly 2 per cent. in the number of cows, the value of the product increased nearly 35 per cent.

In 1900 the value of the total product was $ 27 per cow and in 1910 it was $ 42 per cow. Part of this increase in value must be attributed to a 10 per cent. higher price in the latter year and to the fact that a larger proportion of the total product was sold as market milk, but even after these allowances are made, the figures show a very substantial gain in milk production.

The increase in the yield per cow resulting from better management of the herds is mostly clear profit, and it is only fair to add that much of th e credit for this result is due to the cow-testing propaganda carried on for the last 8 or 10 years by the Dairy Division of the Dominion Department of Agriculture. The farmers are encouraged to test and weigh the milk of the individual cows in their herds in order that the unprofitable ones may be eliminated and the herd built up by rearing the progeny of those that have the best records. This work has only just begun and it is a fair presumption that by the time the next census is taken a still greater increase will be shown.

Figures for the total value of dairy production in 1913 are not available, but if we take the figures already quoted from the census of 1911, which give the value of total products in 1910, and allow the same rate of increase as there was between 1900 and 1910, the value for 1913 is approximately $ 122 000 000.

The value of the different products in 1910 (Fifth Census) was as follows:

Factory Cheese	$ 21 587 124
Home-made Cheese	153 036
Creamery Butter	15 645 845
Home-made Butter	39 889 953
Condensed Milk	1 813 971
Milk and Cream consumed as such, or used for Ice Cream	30 250 005
Total	$ 109 339 934

Canadian Cheese.

The cheese manufactured in Canada is almost entirely of the one kind, resembling more nearly the English Cheddar than any other variety. The Canadian cheesemakers adopted this type of cheese as being the one best suited for the factory system, and because the taste in England, where they looked for a market, was demanding cheese of that character. Canada has not, like most other countries, developed a special type of cheese of any importance. A few families on the Island of Orleans make a limited quantity of a small, soft, highly fermented cheese, which is sold in Quebec City. The process of its manufacture is either a modification or an unskilful imitation of the method employed in making some of the old French varieties, and was first practised in Canada by French colonists early in the 17th century. A few foreign varieties have been introduced, like the Port-du-Salut (French) made at the Trappist Monastery on

the Ottawa River and sold as " Oka " cheese. There are several brands of " potted " cheese on the market, but these are prepared from ordinary Canadian Cheddar.

Condensed Milk and Milk Powder.

The manufacture of condensed milk and milk powders is becoming an important branch of the dairy industry in Canada. There are 12 large factories engaged in preparing these products, and the number is likely to be increased. A total of 69 264 090 pounds of fresh milk was used for this purpose in 1910, out of which there was manufactured 27 831 596 pounds of finished products. The quantities are much larger at present, but the exact figures are not available. The principal seat of this industry is in Western Ontario, and the milk thus diverted from the cheese factories, together with the milk and cream sent to city creameries, is rapidly diminishing the output of cheese in that district. The condensed milk is nearly all disposed of in the Western Provinces.

The Ice Cream Trade.

The quantity of ice cream consumed in Canada has increased enormously during the past five or six years, and its manufacture is an important and a growing factor in the disposal of the milk supply of the country. Statistics gathered from ice cream manufacturers in only 24 towns and cities in 1912 showed that they used the equivalent of over 2 000 000 pounds of butter for this purpose. Instead of being looked upon as a luxury or a confection, ice cream is coming to be considered as a food.

The Export Trade.

Small quantities of butter and cheese have been exported from Canada for over one hundred years, but it was not until about the middle of the nineteenth century that a regular trade of any importance was established. The maximum export of 34 128 944 pounds of butter was reached in 1903 and the largest export of cheese, namely 233 980 716 pounds, was in the year 1904. After 1907 the quantity of butter exported declined rapidly, until in the fiscal year ended March 31st, 1913, less than one million pounds were exported to all countries, and for the first time in over 60 years practically no butter was shipped to Great Britain, the actual quantity being only 681 pounds. The exports of cheese for the fiscal year ended March 31st last were 155 216 392 pounds. In the year 1900, 37 per cent. of the total dairy production was exported, while in 1910 the exports were only 21 per cent. of the total production. The decline in the exports of dairy products in the face of the increase in the production of milk is partly the result of a larger per capita home consumption, owing to the prosperous condition of the people and the improved quality of milk, butter and cheese offered for sale, but it is chiefly due to the large growth in population during the past 10 years.

Comparative Value of Detailed Exports. for Years ended March 31, 1909 *to* 1913.

	1913	1912	1911	1910	1909
	$	$	$	$	$
Cheese	20 697 144	20 888 818	20 739 507	21 607 692	20 384 666
Butter	223 578	2 077 916	744 288	1 010 272	1 521 436
Condensed Milk	25 554	305 678	469 406		
Fresh Milk	1 412	975	4 276	541 372	90 520
Cream	751 123	792 687	1 714 528		
Casein	15 342	38 302	37 009		
	21 714 153	24 104 376	23 709 014	23 159 336	21 996 622

The Factory System.

Although there were over one million cows in British North America in 1861, the outlook for dairying at that time was not encouraging. Progress was impossible under the conditions which then existed. Cows were kept in most cases as a sort of side line and very few farmers specialized in dairying. The production of milk for cheese or buttermaking was limited to the amount of time which the farmer's wife and daughters could spare for that purpose from their other and ofttimes arduous duties, and the supply of dairy products so far exceeded the local demand that prices were unremunerative.

The introduction of the factory system of manufacturing cheese and butter saved the situation by making an export trade possible and opening the way for an increased production of milk with greater profit to the farmer. The first cheese factory in Canada was established in the province of Ontario, in 1864. During the following year, a cheese factory was opened in Quebec. The number of factories increased rapidly in Ontario until about the year 1900, when the suitable territory was fairly well occupied. In Quebec there was not so much progress until after about 1883.

The first creamery in Canada was established in the Province of Quebec in 1873. The organization of other creameries immediately followed in both Ontario and Quebec and later in the other provinces, but there is still a large quantity of butter produced on farms in some districts. There is practically no cheese made on farms in Canada.

The comparatively sparse settlement and small number of cows kept within a reasonable radius of any given point have so far made it impossible to secure sufficient milk to put the cheese factory on a self-sustaining basis in the territory west of the Great Lakes, except in some parts of Manitoba. The result has been that the cream-gathering creamery, whose operations

may be extended to a very wide territory, has been adopted as the most suitable form of the factory system for that part of the country. In this system the farmers who support the establishment provide themselves with hand-power cream separators, and send the cream only to the factory. The cream is delivered over long distances every second or third day, and thus a large saving is effected over the cost of delivering milk every day. As the milk must be delivered early in the morning the area from which it is obtained is necessarily much smaller than in the other system.

Cheese Factories and Creameries in Canada.

The latest returns show that there are 3760 cheese factories and creameries in Canada, and 112 condensed milk or milk powder plants. The cheese factories and creameries are distributed by provinces as follows:

Province	Cheese factories	Creameries	Combined factories	Skimming stations
Ontario	1 019	128	59	1
Quebec	894	576	698	125
Alberta	3	53	1	—
B. Columbia	—	23	—	—
Manitoba	18	30	1	3
N. Brunswick	24	17	3	—
Nova Scotia	7	13	1	—
P. E. Island	17	8	19	—
Saskatchewan	2	17	—	—
	1 984	865	782	129

The cheese factories and creameries are not organized on any uniform plan. Many of them are owned and operated by individuals or firms; other are owned by joint stock companies, the shareholders of which may or may not be milk suppliers.

In the business organization of the factories, either proprietary or joint stock, the milk suppliers are the recognized owners of the product and they usually appoint a salesman, a treasurer and other officers to look afters their interests. In some cases the owner of the factory is appointed salesman.

The owner or company receives a fixed rate for manufacturing, except in very limited districts where the factories are operated on a percentage of the value of the product sold. Where the fixed rate is in vogue, it varies for manufacturing cheese from 1 to 1 ½ cents per pound, and from 2 ½ to 3 ½ cents per pound for butter, according to the locality or the competition between factories for a milk supply.

Recent Work and Progress in the Dairying Industry in Denmark

by

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Thirty years have now elapsed since the economic conditions in Denmark changed to such an extent that the exportation of cereals, which until then had been of considerable importance, fell below the importation of cereals and of feeding stuffs for live stock.

The value of the excess of imports of cereals and foodstuffs over exports has constantly increased during the last thirty years, while the exportation of dairy produce has grown considerably during the same time. The transition from the sale of cereals to the present great sale of butter is especially due to the cooperative dairies. While formerly in each of the large and small cows-keeping farms, about 180 000 in number, butter used to be made, at the present time the whole Danish production of butter is carried on in about 1500 dairies, of which 1200 are cooperative, most of them much larger than the 300 private ones (partly dairies that collect the milk from the producers and partly farm dairies).

In 1882 the first cooperative dairy was founded in West Jutland. A few years previously the cream separator had become a practical machine and was used in some dairies that collected and bought the milk from neighbouring farmers. These collecting dairies, however, as a rule were not successful; they could not pay suitable prices for the milk and did not get enough milk to work up, besides which their produce was often of inferior quality. The cooperative dairies were the first to attain satisfactory results, and they spread in the following years all over the country. Especially between 1887 and 1889 a great number of them were founded, and by 1893 it may be said that the whole country was provided with them.

Each of these cooperative dairies was founded by a group of farmers, who formed a cooperative association, drew up their statutes, elected a managing board, bought building land, bored or otherwise sought for water, built a dairy and a dwelling-house for the staff, bought the necessary machinery and plant and appointed a daiyman who in his turn engaged the necessary assistants.

Every morning the milk is brought to the dairy in hired carts, so that the carriage of the milk is as easy for the producers living at a distance as for those quite close to the dairy. In the dairy the milk supplied by each member is weighed and twice a week its fat content is determined, because it is paid according to its value for butter making. After being weighed the milk is passed through a filter, warmed to 50 to 56° C. (122 to 131° F.) and centrifugated. The cream is immediately pasteurized at 80 to 85° C.

(176 to 185° F.), then cooled and the starter added to it so as to be ready for churning the next morning. Only a part of the skimmed milk is used for making cheese; most of it, on issuing from the separator, is pasteurized at 90 to 95° C. (194 to 203° F.) and then weighed out still warm for the members, to whom it is sent, together with their share of buttermilk, by the milk cart, thus all the members get back their skimmed milk and buttermilk, which they can use in their farms for feeding calves, young pigs, foals or chickens.

The cooperative dairies were principally founded with the object of attaining the complete utilization of the butter-fat contained in the milk of the many small farms, while the manufacture of cheese was but little contemplated. Here and there the new dairies were built and equipped for the making of skim-milk cheeses, but as a rule the greater part of the centrifugated milk, as well as the butter milk, was sent back to the members, and only very few cooperative dairies were induced to take up from the beginning and on a large scale the retail sale of milk.

The production of butter was almost everywhere carried out success. fully. Not only was it possible with the aid of separators to extract more butter from the milk, but as a rule the quality of the butter was much better than that hitherto obtained by the numerous small producers, and was consequently sold at very advantageous prices.

The result was that the cooperative dairies enabled the numerous small farmers to produce butter with the profit which up to then had only been possible for large farms; and even poor cottagers who possess only one cow find it profitable to contribute to the increase of the production of milk.

From the table given below, it will be seen how the butter trade has developed in Denmark. The imports include butter from the south of Sweden and from Finland, Russia and Siberia, which is partly consumed in Copenhagen and partly re-exported by Danish steamers. This importation increased up to the begin of this century and is still fairly important, while the exportation increased much more and has continued to grow.

In spite of the remarkable increase of the population of the towns and the greater purchasing power of the labouring classes, the excess of the exports over the imports of butter has increased to a surprising degree. In this connection it must be borne in mind that Denmark consumes every year large quantities of margarine (91.08 millions of pounds in 1912).

The great increase in the production of butter is partly due to an increase in the number of cows (from about 900 000 in 1881 to 1 282 000 in 1909), but principally to better feeding and better selection and breeding of the milch- cows. Since 1887 in the whole country about 1000 cattle-breeding associations have been founded, which promote the systematic breeding, keeping and development of the cattle of their districts by the following means: purchase and use of one or more special bulls for those cows of the members, which are considered suitable for breeding purposes, by instruction in the management and judging of breeding, by taking part in

Danish Imports and Exports of Butter in millions of pounds.

Year	Imports	Exports	Excess of exports over imports	Including milk and cream
1865-69 average	1.17	10.85	9.68	—
1870-74 » . . .	4.03	22.79	18.77	—
1875-79 » . . .	5.43	28.95	23.52	—
1880-84 » . . .	7.61	32.05	24.44	—
1885-89 » . . .	11.88	55.73	43.85	—
1890-94 » . . .	27.81	107.23	79.42	—
1895-99 » . . .	36.65	145.20	108.75	—
1900-04	50.58	195.89	145.31	—
1905	41.80	208.10	166.30	3.10
1906	41.38	208.89	167.51	5.83
1907	40.57	226.86	186.30	6.29
1908	32.71	230.16	197.45	6.16
1909	35.97	233.79	197.82	8.25
1910	30.50	231.40	200.82	12.39
1911	37.62	243.91	206.29	15.22
1912	32.19	234.54	202.36	20.97

cattle shows, by keeping herdbooks, etc. Since 1892 (1), upwards of 500 milk-record associations have been founded with the object of demonstrating the profitableness of cattle breeding and of promoting the formation of lines of cattle capable of yielding a milk richer in butter. The means employed are investigations into the feeding and into the quantity and the fat content of the milk yielded by the individual cows of the members' herds.

As regards the quantities of fodder consumed, it must be noted that while up to the year 1883 the exports of cereals were in excess of the imports and the sale of cereals was an important source of income for both large and small farmers, at present a majority of farmers feed all their crops to their

(1) The first milk-record account with data on the milk and butter yield and consumption of fodder of every individual cow during the year was published in the *Malkeritidende*, 1894, pp. 37-40.

stock ; and though considerable quantities of cereals are still sold, the value of bought foods, especially maize, wheat bran and oil cakes, greatly exceeds them, while at the same time the areas devoted to root crops for feeding purposes are steadily increasing. In 1912 Denmark had an excess of importation of maize and other cereals valued at about £2 200 000, and of bran, cakes and the like worth £4 190 000. At the same time live cattle and beef worth £3 113 000 and bacon and other meats to the value of £8 327 000 were exported (1); further, the better feeding of cattle and pigs produces now considerable masses of manure which serve to increase the productiveness of the fields and diminish the evil effects of unfavourable weather.

The increasing quantities of milk have had the result of rendering the original buildings of most dairies too small for present requirements. In many places buildings had been run up as cheaply as possible for fear of incurring the burthen of heavy interest on the capital of expensive plant in case of a fall in the prices of butter. But as dairying proved profitable and the quantities of milk increased, the means were soon found where with to enlarge the buildings and to provide new and suitable machines and implements.

The constant endeavour is not only to keep the dairies in good condition, but also to equip them always better, so as to be in a position to produce butter of a finer and more uniform quality ; in this respect the publicly appointed consulting experts, as well as two good dairy schools, have rendered most valuable services.

The Agricultural Laboratory of the Royal Veterinary and Agricultural College has also contributed much to the general progress. Further, numerous large and small exhibitions exert an effective control as regards the quality of the butter, and the so-called Farm-Statistics Bureau, which undertakes the elaboration of a number of yearly accounts kept according to a uniform system, has for many years been a useful guide in the economic management of farms. At first it was chiefly the question of the erection of ice-houses and of procuring larger and better steam boilers and engines, and of laying down better floorings and water supply; later came the apparatus for pasteurizing cream and for multiplying the acid bacteria, or the demand for better separators; now, in recent years, refrigerators, eletric lighting and bathrooms are the items that cause much expenditure.

Instead of the former small cheap dairies, now, in many localities, large dairies with lofty well-ventilated workrooms are to be seen ; they are well provided with steam power, refrigerating plant, electric lighting and such an abundance of good separators and other appliances, that every day two to four thousand gallons of milk are separated in about three hours.

Since 1904, several dairies, especially in the south of the country, have begun to export cream to Germany, whilst most of the butter is now, as formerly, exported to England. This is due to the fact that Germany

(1) The value of the excess of exports of butter, milk and cream amounted in 1912 to £11 425 000.

imports ever increasing quantities of dairy produce, and as butter pays a duty of 10 per cwt. while cream is duty free, the importation of cream offers a greater margin of profit, notwithstanding its greater weight. The figures given in the table on page 169 show that the exportation of cream from Denmark has of late years steadily grown.

It must also be mentioned that of late years the production of cheese has been encouraged in many ways. There are not only several milk-collecting dairies which manufacture varius kinds of cheese from whole milk, but also many large cooperative dairies which make cheese partly from whole milk and partly from a mixture of whole and skimmed milk. For many years attempts had been made to manufacture cheese from pasteurized milk; by 1906 there were already 25 dairies that used pasteurized milk in the manufacture of cheese. In many dairies during recent years new and good cheese stores with insulating walls and refrigerating plant have been built in order to protect the cheeses against too much heat in summer. At present about 55 million pounds of cheese are made every year in the country.

The great demand for casein in the year 1910 led to the erection of about 20 casein-drying establishments, to which a great number of dairies delivered fresh casein, so that in 1911 more than 3.3 million pounds of casein, worth 3 ½*d* a pound, were exported. In 1912 the fall in prices limited the production rather suddenly.

Lastly, it must be mentioned that a few years ago a condensed milk factory was built at Nakskov in Lolland; in 1912 it exported £82 500 worth of condensed milk.

Basis of International Statistics of Agricultural Book-keeping

by

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I. GENERALITIES.

For the examination of the economic conditions of farming the methods based on book-keeping give the most complete and reliable results, much superior to those obtained by means of enquiries by question sheets. Recognizing this fact the collection of the results of agricultural book-keeping has been commenced of late years in several States. But in order that the figures obtained from several farms should be comparable with each other, it is necessary that they should be collected and elaborated according to the same methods.

If the results of individual central offices for book-keeping are to be compared with each other, similar conditions must prevail in all. The value of these observations increases the more they can be compared with other

similar material; it is necessary therefore to give them a *uniform basis* from both the scientific and the practical points of view. The sooner uniformity is introduced in this direction, the more easily will the final aim be reached, for as long as this work is in its initial stages it will be much easier to prevail upon the book-keeping offices to adopt uniform methods, while later any modification of methods would complicate matters and interfere with the comparison of later and earlier results.

The following chapters are an attempt to outline the plan to be followed for this unification, and they will discuss the following subjects:

1. Definitions.
2. Valuation.
3. Methods of book-keeping.
4. Closing of accounts.
5. Elaboration of results.

II. — Definitions of the terms used.

The first condition to be fulfilled for the success of the investigation consists in defining the terms employed, and especially the following: *Agriculture* (Landwirtschaft), *Classification of capitals* (Kapitaleinteilung), *Gross product or gross returns* (Rohertrag), *Expenses* (Aufwand), *Net product or net returns* (Reinertrag), *Income* (Einkommen), *Income from whole estate* (Vermögenrente), *Compensation of labour* (Arbeitsverdienst), *Returns from the farm* (Landgutsrente), *Ground rent* (Grundrente), and *Capitalization value* or value based on returns (Ertragswert).

1. — *Agriculture*. The enquiries must bear on the farming. The term agriculture includes not only the cultivation of the soil, but also the working up of the crude products, especially in the form of keeping live stock. Thus accessory industries such as dairying, wine making, distilling, brewing, sugar making and so forth, also belong to agriculture, in so far as they work up the crude products of a given farm. On the other hand if great quantities of crude products are bought outside the farm so that the industry is no longer bound to the property, it is better to detach the whole accessory industry from the agricultural part and to treat it as a non-agricultural or private undertaking.

The *excavation of peat, gravel* and the like belongs to agriculture in so far as it is carried on chiefly with the object of utilizing fully the teams and labour kept for agricultural purposes. The same may be said of the woods. Large forests, the utilization of which is but loosely connected with the farm, should be separated from the agricultural work, and this especially when the average gross returns of the wood form a considerable part and even more than half of the total gross returns. In the same manner game and fish are to be considered. Pond fishery may always be classed with agriculture.

Trade in agricultural produce must also be separated completely when the property does not contribute its crude products or its teams and labour.

In the latter case the same rules are to be observed as for the accessory industries.

Credits and investment of capital (Kapitalanlagen) and their returns, are not connected with agriculture except in so far as they have originated in produce of the farm or act as a reserve for it.

The private family account or *personal account* (Privatverbrauch) must be separated from the farming account. The farm must not pay interest on those portions of the estate which are used for the family account, which must not be considered in calculating the net returns on the capital, except to the extent that the farm has received compensation for rent or other supplies enjoyed by the private household. The more completely the calculating of such rents can be avoided and these capitals kept apart from the agricultural book-keeping, the more accurate will this be.

2. — *The capitals*. All the parts of one's estate that are used in farming and which concur in producing profits are called *assets* (Aktivkapitalien) of the farm. In describing the assets of a farm, the land and other things rented or farmed by the farmer must be included, in particular, the value of the farmed property. If this is not possible, they are to be treated separately and their results kept separate from those of the property, the assets of which are well known. This is not only necessary because the unitary measure, the assets, is wanting, but also because the amortization, the taxes and the like can not be completely brought into the accounts.

As opposed to the assets are to be considered the *debts or liabilities* (Passivkapitalien). They comprise all obligations which have arisen, whether from the acquisition of the assets or from the working of the farm. Debts covered by mortgages, the origin of which is no longer known, in so far as they affect portions of the agricultural assets, are treated at the beginning of the accounts as farming liabilities.

The most important division of the assets consists in setting apart what belongs to the farm. That the soil, with the water sources and rights connected with it, the improvements and the buildings, form part of the farm, there can be no doubt. But when the trees, and still more the field inventory, that is the value of the seeds and of the labour expended in sowing them, is considered, then the uncertainty begins. We recommend including in the farm capital account everything that is connected with the soil, including the trees, vines and field inventory, and to designate this as *farm capital* (Landgutskapital). The purchaser of a farm can always under every civil code claim that these objects be considered as an integral part of the property unless they be expressly excluded in the contract. Only when the plants are separated from the soil does the question arise as to whether they belong juridically to the soil or not. Whether these capitals are to be designated as farm capital or as ground capital does not matter. What is important is that they include the same elements. We prefer the expression farm capital (Landgutskapital) because it is more comprehensive than the much used ground capital and gives less occasion for confusion with bare soil capital.

This latter term should include all those parts of the assets which are not consumed by usage. They may, it is true, be destroyed (for instance; land carried away by floods), but usually they are not liable to deterioration and they require no amortization. To this group belong the soil and the atmosphere over it, the springs and the rights pertaining to the soil. The soil capital represents the permanent and indestructible component of the farm capital and consequently differs from all other forms of capital.

That part of the assets which does not belong to the farm capital is grouped under the name of *farming capital* (Pächterkapital) and includes dead stock (Geräte und Maschinenkapital), live stock (Viehkapital), stores (Vorrätekapital), credits (Guthaben) and cash working reserves (bare Betriebreserven). These three last capitals form together the *circulating working capital* (umlaufendes Betriebskapital).

The two terms farm capital (Landgutskapital) and farming capital (Pächterkapital) are quite separate. How far each component of wealth belongs to the agricultural assets is shown by the definitions of agricultural capital and agriculture.

3. — *Gross returns* (Rohertrag). The results of agricultural work expressed in terms of quantity and value of the produced, improved or acquired products are called gross returns. This term means the final gross yield of the whole farm, or essentially the agricultural produce that has been sold or used by the household or by the accessory industries, and to which is added that produce which has gone to increase the original capital and the stores, and is thus included neither in the receipts nor in the produce supplied by the farm to the household and auxiliary industries.

However simple the calculation of gross returns may appear at first sight, it is attended by a series of difficulties. Of the *receipts* only those for farm produce sold are to be entered. *Credits* for the same are to be added at the end of the year. Receipts for credits belonging to previous years are to be excluded.

As *farm produce* not only the crops but all returns of the farm in the sense of the above definition are to be considered, consequently also the receipts from the accessory industries, rents for those parts of the capital that have been used by the farmer's family, etc.

The receipts from the sale of land, improvements, buildings, machines and implements do not belong to the gross returns.

Especial attention is required in the treatment of *purchased raw materials* and *animals*. The gross returns of live stock keeping would be erroneously represented if the animals sold, their produce delivered to the farmer and his family, as well as the increase of the live stock, were entered without deducting the value of the animals bought, since these were not produced by the farm. The same may be said of those agricultural products which are not transformed in the farm but are only sold again. Similarly fruit that is bought for the manufacture of wine or cider, milk bought for the dairy, potatoes for the distillery and so forth must be deducted from the gross returns. On the other hand fodders and manures purchased,

as well as seeds, are not to be deducted from the gross returns, as they are entered among the expenses. All purchased wares which have been deducted from the gross produce are naturally not be included in the expenses.

The comparison of gross returns will be improved by deducting from them the extraordinary expenses incurred for disposing of the produce, such, for instance, as the expenses for railway carriage of produce to be sold.

Among the items of gross returns the supplies in kind to the employees and labourers are included. Their value increases the labour bill by the same amount. If both were to be left out, the net returns would be equally correct, but both working expenses and gross returns would be too low in comparison with those farms in which wages are given in cash and not in kind.

If the stock of provisions produced by the farm has increased, the increase is entered as a component part of the gross returns. But how is the opposite case to be treated, that is when the stock of provisions has diminished? As a rule the decrease must be entered among the working expenses, that is to say not deducted from the gross returns. The case is to be considered like the purchase of provisions, especially fodder, manures and seeds; we do not subtract these from the gross returns, even when they are bought. Only when they are provisions destined to be sold is it more correct to deduct them from the gross returns. Their original amount was in fact contained in the gross returns of the preceding year as inventary at the end of the year's operation; being then sold in the course of the next year these provisions appear among the receipts again as gross returns. If they were not deducted the gross returns would be too high.

A part of the gross returns may also have been employed as *installation capital* (Anlagekapital) in the farm itself, for instance, timber for buildings. Supplies of goods for such objects are to be reckoned as components of the gross returns, and those used for the live stock capital, for the trees and other plants (in so far as they are installation capital) appear in the variations of stock in hand at the end of the year as compared with that at the beginning.

It is to be observed that for crops and animals only the *difference between amortisement and increase* is determined. To proceed with more precision, those individuals the values of which had increased and those the value of which had diminished should be treated separately and the increase of the former and the amortisation of the latter introduced into the accounts. The amortisation is to be included among the expenses. This more precise method is especially to be recommended for live stock keeping, but it renders special control of the live stock necessary, which is not customary in simple book-keeping. Consequently in general this distinction is not practised. For the draught animals, especially the horses, a special account is required, so that their amortisation does not appear in the increase of the total live stock, but always among the working expenses.

Increases in the value of the soil, buildings, improvements, machines and implements not owing their origin to supplies from the farm are not comprised in the gross returns. Consequently such increases of value due to purchases or to improvement of market conditions must not be included in the gross returns.

These considerations show that the definition of gross returns given at the beginning is not enough for practical work, but that it must be completed by further explanations. The following summary contains all the factors to be considered for an exact definition of gross returns.

Gross returns.

A. — *Receipts in cash from farm produce,* including the credits from the same source existing at the end of the year. (N. B. The credits existing at the beginning of a year of operation must be kept separate and do not enter into the account of receipts nor into that of credit at end of year).

a. — Receipts from plant products.
b. — " " animal products.
c. — " " accessory industries (dairying, etc.).
d. — " " letting of agricultural assets.
e. — " " interest of reserve agricultural capital.

B. — *Products of farm delivered to labourers paid in kind, to the household and to the family.*

a. — Plant products.
b. — Animal products.
c. — Products of accessory industries (dairying, etc.).
d. — Rents of farm assets used by the household or family.

C. — *Increase of the stock of farm products at the end of the year over that existing at the beginning of same year.*

D. — *Increase of the stock of animals, fruit trees, standing timber, vines and field inventory over that existing at the beginning of year.*

E. — *Supplies of farm products to the soil, improvement, building, machine and implement capital.*

From the above amounts the following are to be deducted in so far as they are contained in them:

1) *Expenses for purchase of live stock.*
2) " " " " *plants.*
3) " " " " *crude material* for the accessory industries (milk for the dairy, fruit, grapes, cider, must for wine making, potatoes for distilling, etc.).

4) *Expenses for purchase of agricultural produce destined to be sold again,* in so far as their value or the product of their sale is included in the gross returns.

5) *Extraordinary expenses for sale of produce* (railway carriage for milk and the like).

N. B. Similarly to these expenses, the debts for heads A to E are to be included at the end of the year, as well as all supplies from the accessory

industries to the household. Here also the debts from previous years are to be excluded.

4. — *Working expenses.* These represent the use and the outlay of money values required for the production of the gross produce, with the exception of the interest on capital. We designate the sum of working expenses plus the interest on capital as *Cost of production* (Produktionskosten).

The working expenses include the cash outlay and the corresponding debts at the end of the year for seeds, manures, feeding stuffs, wood and other items of stores which have been used or are devoted to obtaining the gross product, besides those delivered by the household and by the private accounts to the farm, and further the amortisations and the outlay on labour. In order to establish the working expenses, what has been said on the gross produce must be considered. Nothing that has already been excluded from the gross produce must be included here.

Only the outlay for working the farm is to be included in the working expenses. Consequently all outlay for the purchase of land, improvements, buildings, machines and implements, as well as investments of capital (Kapitalanlagen) current accounts, deposits in savings banks, purchase of shares and stocks, must be separated. As for the way of considering purchases of live stock and plant capital, it has been sufficiently discussed under the head of gross returns. The debts at the end of the year are included, while debts from previous years are to be deducted.

Personal supplies and those from the household are to be treated like the outlays or debts.

All those constituents of the installation capital which are not wholly included in the working expenses must be represented in these expenses by a quota of amortisation corresponding to their wear and tear. In order to calculate this, the principle must be maintained that their original value minus their final value must be as equally as possible distributed over the number of years that the object is likely to last.

The heading *labour expenses* includes not only the wages in cash, but also all those in kind, the board for farm servants in the household (participation in household expenses) and the wages of the farmer and his family. In fixing the amount of this last item the same salaries and wages must be calculated as would have to be paid to strangers, both for manual labour and for management. In large farms the upper limit for management is about 1 per cent. of the assets.

Expenses for the *interest on debts* and their *repayment* do not belong to working expenses. As for the rate of interest on the capital invested, it must be fixed independently of the working expenses. It is useful and interesting from several points of view to fix this rate. It may be done by adding to the interest on debts the interest of the net assets. But for comparisons it is better not to consider the debts, but to calculate the interest on the whole assets capital at a determined rate, namely that which the farmer would get on his money if deposited in a bank. If greater precision is desired, each group of capitals should bear a different rate of

interest accoding to the uninsurable risk to which it is exposed. But ti is sufficient to adopt a uniform rate of interest for the total asset capital.

Opinions differ as to the way of dealing with *rates and taxes* (Steuern u. öffentlichen Auflagen). Anyhow they cannot be reckoned as working expenses except to the extent that they are laid upon the capital of the farm and upon the income derived from it. A joint stock company will never doubt for a moment that taxes belong to its business expenses. Also other enterprizes managed by juridical persons consider taxes in this way. Why should it not be the same with enterprizes managed by private persons? We recommend therefore that all taxes connected with agriculture be reckoned with the working expenses, and in principle all prestations in kind also. But as in book-keeping by single entry they are not included in the gross returns they are omitted here, and the net returns are diminished by their amount. This question will be treated again when the net returns are discussed.

Summarizing then: Working expenses include the following factors:

1). *Outlay iu cash for capital in stores* including debts at the end of the year. (N. B. The debts at the beginning of the year are to be left out and are not to be included either in the cash outlay or in the debts at the end of the year.)

2). *Outlay in cash for labour* for working the farm (farm hands, veterinary, etc.)

3). *Cash outlay* for taxes.

4). *Articles for working the farm* drawn from the stores-capital of the household and family.

5). *Outlay on labour.*

6). *Amortisation of installation capital.*

7). *Diminution of the stock of stores-capital* at the end of the year as compared with stock at beginning of year. From this is to be deducted:

The increase of the items of the stores-capital not included in the gross products (artificial manures, cakes, sulphate of copper, etc).

5. — The *net returns* (Reinertrag). Under this term is understood the difference: gross returns minus working expenses. This value represents the revenue from the whole of the assets (Aktivkapital).

It emerges from the above that it is not possible to give net returns a more concise definition or one answering better to the requirements of the practice of book-keeping. The most important thing is clearness and uniformity of principles in the calculation of gross returns and working expenses.

To what has already been said there is not much to add, but a few more words on taxes and burthens are necessary.

The net returns calculated according to our method represent the returns that remain to the farmer after having paid taxes and burthens. It serves to calculate the value of the land based on its returns, or capitalization value (Ertragswert des Bodens). If, for instance, a co-heir takes his share under the form of capital calculated according to the value of the returns,

he takes too little, because he exchanges a capital calculated as free from taxes against another one subject to them. But this difference is compensated by the fact that the rate of capitalization is frequently so low that the usual taxes on capital are already deducted. It must be noted also that farming is often burthened with considerable special taxes which capitalists do not know (obligatory labour, land tax without deduction of debts, etc.). The higher these burthens, the lower the price that the farmer pays for the land. Calculating the value of the returns without taking these burthens into account would be misleading. So long as it is a question of general taxes, the lower rates of interest offer sufficient compensation; for special taxes the deduction is justified. But to obtain the net returns of the farm free from burthens, the taxes must be added to the net returns. The best method is to designate this value as *tax-free net returns* (Steuerfreier Reinertrag).

6. — *Yield of the estate* (Vermögensrente). We call yield of the estate that part of the net returns which represents the interest borne by one's estate; it is found by subtracting the interest on the debts from the net returns.

7. — *Income* (Einkommen). Income can be defined as the money value that one may consume without diminishing his estate. It is thus found by adding to one's consumption the increase of the estate, or by subtracting from the consumption the diminution of the estate. In this income, however, accessory income may be included: this must be subtracted in order to find the *agricultural* income. This is found when the interests on debts are subtracted from the net returns, and the salaries and wages of the farmer and his family are added; or, what is the same, when the yield of the estate is added to the above salary and wages. The income can also be defined as the difference between gross returns and working expenses without the salary and wages of the farmer and his family, but with the interest on debts.

8. — The *compensation for labour* (Arbeitsverdienst). This term designates that part of the agricultural income which is left to the farmer as compensation for his work after he has calculated the customary local interest on the capital that he has put into the farm. The compensation of labour is thus found by subtracting from the agricultural income the amount of the interest on the estate without debts (Reinvermögen).

9. — The *components of the net returns* (Bestandteile des Reinertrages). When a certain amount is deducted from the net returns for interest on the farming capital, the returns of the farm itself (Landgutsrente) remain, and when from this the interests on the capitals representing crops, buildings and improvements are deducted, the ground rent (Grundrente) remains.

The farm returns thus represent the interest on the capital invested in the farm, and the ground rent the interest on the capital invested in the bare soil. The latter capital is distinguished by the fact that its sources, namely the soil and the air, are imperishable, and though it may vary it can never be permanently exhausted.

10. — *Value based on returns* or *capitalization value* (Ertragswert). The value of the farm based on returns can be calculated from the net returns. It means the amount of money which, in a perfectly safe investment at the usual local rate of interest, would yield the same sum as the returns of the farm. The sum which would yield the equivalent of the ground returns (Grundrente) is the value of the bare soil based on returns (Ertragswert des Bodens). The rate of interest chosen is based upon the interest borne by the safest State loans or by first mortgages.

It must, however, be considered that in the net returns all the expenses for management, taxes and insurance have already been deducted, so that the rate of interest must be correspondingly lower.

The value based on returns may also be calculated by capitalizing the whole net returns and then subtracting from it the amount of the farming capital and of the capitals in crops, buildings and improvements.

11. — *Difference of net returns* (Reinertragsdifferenz). If from the net returns, the sum which would be necessary to represent the interest of the estate (Aktivkapital) at the usual local rate be deducted, the difference of the net returns remains. This value may be positive or negative and it is important, especially for the calculation of the cost of production.

III. — Valuation

The question of valuation is more important for agricultural book-keeping by double entry, in which the net returns are decomposed into their elements, than for the present enquiry. The major part of the gross returns and of the working expenses, according to our definition, is composed of values for which the prices paid or received are stated. Anyhow a valuation must be made for the inventories at the commencement and at the end of the year. Nevertheless the enquiries of the Swiss Peasants' Secretariat have shown that on an average of the years 1908-11 the increases of inventory represent only 3.3 per cent. of the total gross returns; the diminutions of stores represent 2.5 per cent. of the total working expenses, while a further 5 per cent. of the expenses come from amortisation. These figures show clearly how slight is the influence of the estimation of the value of these changes upon the final result. But the valuation of the installation capital is also important inasmuch as the estate serves as a measure of the returns. According to the valuation of the farm, the same net returns seem high or low.

Agricultural book-keeping can give no information on the interest-producing power of capital invested in agriculture, unless the principle be

observed of valuing the installation capital (Anlagekapital) at its cost price (Gestehungskosten), that is, entering the sum that would have to be spent in order to obtain the object considered. The quotas of amortisement with which former years of operation have been charged must be deducted.

Those provisions or stores destined for the consumption of the household or family must be entered at the price that would be realized free from all expenses (Reinerlös), or at the probable price at which they could be sold for being further worked up (Veredlungswert) (price minus sale costs and risks).

We must restrict ourselves to these two fundamental principles, as we cannot engage here in the details of the theory of valuation. Besides, the observance of these two principles is sufficient to render the results of book-keeping comparable.

IV. — The method of Book-keeping.

The number of manuals and methods of agricultural book-keeping is infinite. The attempt to give uniformity to all these systems is hopeless, and it would collide with the interests of many engaged in the publication of such works.

Fortunately, in order to make comparable statistics of agricultural book-keeping it is not necessary to follow only one system of book-keeping. Whether the single entry, or the double entry, or the American, Italian or German system be followed is immaterial, provided one condition be fulfilled, namely that all intercourse of the farm with the outer world be completely controlled and separated. By the outer world, not only the market and the usual customers are meant, but also the head of the enterprise, his family, household and accessory industries. Everything that the farmer draws or supplies must be noted and entered as if he were a customer who bought or sold on credit.

Consequently the following books are indispensable:

1. An *inventory*, in which the capital is entered and its variations are regisstered.

2. A *cash book* for registering the amounts of cash received or paid out.

3. A *housekeeping* or *farmer's book* for the registration of produce in kind delivered to or received from the household, private consumption or accessory industries of the farmer.

In what manner the entries into these books are to be made and whether they are to be supplemented by other books, the book-keeper is left free to decide (1). The only thing to insist upon is that all the entries be arranged in such a way that at the end of the year they may be distributed to the following accounts: *farm, common household, personal consumption and accessory industries*. In large estates where the family of the manager and the em-

(1) A comparative representation of the various systems of book-keeping adopted in farming will be found in my treatise: *Grundlagen und Methoden der Bewertung, Buchhaltung and Kalkulation in der Landwirtschaft*. P. Parey, Berlin, 1911.

ployees have separate households, that of the latter is connected directly with the farm and that of the former with the personal consumption account. The household account is then omitted. In peasant farms this account is necessary in order to distribute the housekeeping expenses according to the number of days that the various hands were present. It is also possible to close the accounts correctly for the farm alone without separating personal consumption from accessory industries; but to obtain the amount of total income and total consumption, the whole capital, the whole cash turnover and all exchanges in kind must be divided between the four accounts: farm, household, consumption and accessory industries. This system also renders the auditing of the books by the central book-keeping stations much easier. Detailed instruction on the way of keeping such an account is given in the writer's works (1).

V — Closing of Accounts.

The manner of closing the accounts depends partly on the system of book-keeping followed. As it is impossible to obtain uniformity in the systems of book-keeping, it is evident that the way of closing accounts must vary greatly. The legislation on taxes alone is enough to render uniformity in this respect impossible.

If it were enough to determine the net returns, the income and the values deriving from them, the final results of the most different books could be collected, provided that in calculating these values, the principles of the above definition had been observed. This, however, would not succeed in every case, as the legislation on taxes frequently renders variations necessary. For this reason, and still more because international book-keeping statistics are valuable especially on account of the comparison between gross returns and expenses, we recommend a special closing of accounts for the object of an international enquiry, to be adopted besides the usual closing for local purposes. Every book-keeping institution keeps its usual system of closing accounts, but with the help of its books makes another balance as a basis for scientific investigation.

This second closing of accounts would consider its chief task to consist in the resolution of gross returns and expenses into their elements. For this purpose the items of the inventory of the cash book and of the housekeeping book should be distributed in as many groups as there are divisions in the gross returns on one hand and in the expenses on the other. Each division is an account with Dr. and Cr. which may be kept according to the German or Italian method, but not the American, because the number of accounts

(1) Laur, *Grundlagen und Methoden der Bewertung, Buchhaltung und Kalkulation in der Landwirtschaft.*

Laur, *Landwirtschaftliche Buchhaltung für bäuerliche Verhältnisse.* 5th Edit. Aarau, 1913.

Laur, *Comptabilité agricole de la petite et moyenne culture.* Published by the Union suisse des Paysans, 2nd Edit. Brugg, 1913.

is too large. Still simpler is the following system, which resembles the American system, but in reality has nothing to do with it; it is rather German book-keeping in which a line is given to every account. The texts of the individual entries which are usually written under each other in the account are here in the heading of the table. This leads to the double advantage of not having to write the text and of being able to condense the whole closing of the account in a few pages.

The system is described in my work: *Grundlagen und Methoden der Bewertung, Buchhaltung und Kalkulation in der Wirtschaft,* (Berlin 1911) at page 355. Here an instance is shown in the tables at the end of this paper.

VI. Elaboration of Results.

In order to compare the results of book-keeping with each other, they must first be reduced to a common measure. We describe below the method applicable to those values which it would be especially desirable to render comparable and to publish in a uniform manner.

a) *Net returns.* — This important value is given per hectare (2.47 acres) of cultivated area and in percentages of the capital.

b) *Agricultural income.* — As general measure only the extent is to be considered. For peasant conditions the number of days' work of the farmer's family, reduced to days' work of an adult, is a preferable measure.

c) *Returns of whole estate.* — This is compared to the net estate invested.

d) *Compensation of labour.* — This value is utilizable only for peasant conditions. It is measured by the number of days' work of the farmer's family.

e) *Value of the farm based on returns.* — Besides the area, the gross returns are especially suitable as a measure. The ratio between value based on returns and the gross return, or the factor of the capitalization value, is of especial importance for the valuation on the basis of returns.

f) *Gross returns.* — It is not enough to calculate the total sum of gross returns per unit of area; the composition of the gross returns must also be analysed as is shown by the example given. The individual sub-groups can also be reduced per unit of area, but it is especially important to calculate the percentage composition of the gross returns.

g) *Working expenses.* — The same may be said for this item as for the gross returns. It should be expressed in its totality and in its constituent parts, per hectare and according to percentages.

h) *Difference of net returns, or the farmer's profit.* — This value is compared with the gross returns. The figure shows by how much per cent. the average prices obtained must be increased or lowered in order that the gross returns thus calculated should cover the whole of the expenses, including the compensation for the farmer's family and the interest demanded by the capital. The price modified by this factor thus represents the *cost of production.*

Dr.

Assets at beginning of year	Credits at beginning of year	Liabilities at end of year	Expenses	Received from: Farm	Received from: Household	Received from: Accessory industries	Received from: Private consumption	Gross returns	Sums
Fr.	Fr.	Fr.	Fr.	Fr.	Fr.	Fr.	Fr.	Fr.	Fr.
42 980 —		10 800 —	5 700 —						59 480 —
29 490 —				2 050 —					31 540 —
				20 —					20 —
5 368.70				87.90					5 456.60
				800 —					800 —
			9.40						9.40
137 —			319.60		20 —				476.60
			72.20						72.20
			56.40						56.40
			5 —						5 —
			24.75						24.75
			24.50						24.50
220.10			1 182.75						1 402.85
			654.10						654.10
		50 —	92.05		8 —				150.05
			282.20		184.50				466.70
			2 232.60	40 —					2 272.60
			374.65						374.65
			384.90						384.90
			249.75						249.75
			388.30						388.30
			126 —						126 —
		40.80	150.60						191.4
78 195.80		10 890.80	12 329.75	2 997.90	212.50				104 626.75

DR.

Assets at beginning of year	Credits at beginning of year	Liabilities at end of year	Expenses	Received from: Farm	Received from: Household	Received from: Accessory industries	Received from: Private consumption	Gross returns	Sums
101 480.50	6 085.05	10 890.80	21 632.80	2 997.90	1 698.73		2 586 —	16 038.70	163 410.48
100 —								75 —	175 —
								389.60	389.60
								16 —	16 —
101 58050	6 085.05	10 890.80	21 632.80	2 997.90	1 698.73		2 586 —	16 519.30	163 991.08
								16 519.30	
6 085.05									
417.35									417.35
		409.75	432 —						841.75
1366.70			1 361 —	2 563.95	Interest of capital 68,33		Including compensation for wages 714 —		6 073.98
5 265 —			2 142.80	292.20	Board 2 665.40				10 365.40
								Income from household 782.33	782.33
5 548 —								Income from accessory industries 1 638.50	7 186.50
				Net interest on liabilities 445.75				Income from farming 6 374.07	6 819.82
								Total gross income 8 794.90	8 794.90
120 262.60		11 300.55		Total gross income 8 794.90					140 358.05

Accounts	Assets at end of year	Credits at end of year	Liabilities at beginning of year	Receipts	Supplied to: Farm	Supplied to: Household	Supplied to: Accessory industries	Supplied to: Private consumption	Working expenses	Sums	Remarks
Brought forward.	105 256.60	1 458.30	16 573 —	22 408.15	2 997.90	2 430.55			12 285.48	163 410.48	
14. Gross product of goats.											
15. » » » sheep.	100 —			55 —				20 —		175 —	
16. » » » bees.											
17. Rent of buildings.						92.40 25 —		272.20		389.60	
18. » » plots.						16 —				16 —	
19. Labour for improvement and increase of farm and dead stock.											
20. Labour in other farms.											
21. Interest on reserve capital.											
Total.	105 356,60	1 458,80	16 573 —	22 463.15	2 997.90	2 563.95		292.20	12 285.48	163 991.08	
Net returns.									4 233,82		
Total.									16 519,30		
Credits.	1 458.80										
Cash in hand.	33,20									33,20	
Interest on liabilities.			396 —						Net interest on liabilities 445.75	841.75	
Household expenses.	1 521,05			188,80	212,50				* Household expenses 4 151.63	6 073.98	
Consumption.	5 255 —								Consumption 5 110.45	10 365.40	
Income from household.						Interest of capital 68.33		Compensation for wages 714 —		782.33	
Income from accessory industries.	4 654 —			2 532,50						7 186,50	
Income from farming.					Net returns 4 233,82			Compensation for wages 2 586 —		6 819,82	
Total gross income.					Income from farming 6 374.07	Income from household 782.33	Accessory income 1 638.50			8 794,90	
Total capital.	118 278.65		16 969 —					Consumption 5 110.40		140 358.05	

** Distribution of household expenses.*

Board days of farm	842
» » accessory industries	—
» » personal consumption	1 511
Total days	2 353

Expenses per day $= \frac{4151.63}{2353} = 1.76$ fr.

Distribution:

Farming	$= 842 \times 1.76 =$	1 486.23
Personal consumption	$= 1511 \times 1.76 =$	2 665.40
	Total	4 151.63

Accounts	Assets at end of year	Credits at end of year	Liabilities at beginning of year	Receipts	Supplied to: Farm	Supplied to: Household	Supplied to: Accessory industries	Supplied to: Private consumption	Working expenses	Sums	Remarks
	Fr.	Fr.	Fr.	Fr.	Fr.	Fr.	Fr.	Fr	Fr.	Fr.	
I. Accounts of the working expenses proper.											
A. Soil-Capital.	42 980—		16 500—							59 480—	
B. Accounts with amortisement.											
1. Capital in buildings.	31 270—								270—	31 540—	
2. » » improvements.											
3. » » fruit trees.									20—	20—	
4. » » vineyards.											
5. Dead stock.	4 916,10								540,50	5 456,60	
6. Live stock:									800—	800—	
a) Cattle.											
b) Horses.											
c) Goats.											
d) Sheep.											
e) Various.											
C. Accounts of working expenses.											
1. Purchase of inventory sundries.									9.40	9.40	
2. » » manure.	22.20								454.40	476.60	
3. » » forage seeds.									72.20	72.20	
4. » » cereal seeds.									56.40	56.40	
5. » » seed potatoes.									5—	5—	
6. » » other seeds.									24.75	24.75	
7. Sundry expenses for forage crops.											
8. » » » cereal »											
9. » » » potato »									24.50	24.50	
10. » » » fruit growing.											
11. » » » vineyard.											
12. » » » sylviculture.											
13. Purchase of concentrateds.	133—			81.25					1 188.60	1 402.85	
14. » » grain for feeding stock									651.10	654.10	
15. » » hay.											
16 » » roots for feeding.											
17. » » litter.											
18. Veterinary and medicines.			40—						110,05	150,05	
19. Sundry expenses for live stock.						10—			456,70	466,70	
20. Repairs to buildings.					2 050—				222.60	2 272.60	
21. » » dead stock.				5—	87,90				281,75	374.65	
22. Taxes.									384.90	384.90	
23. Insurance.									249.75	249.75	
24. General management expenses.									388,30	388,30	
25. Rent of plots.											
26. Pasturage.									126—	126—	
27. Cartage.											
28. Motor power.			33—						158,40	191,40	
Carried forward	79 321.30		16 573—	86.25	2 137.90	10—			6 498,30	104 626,75	

Gross returns	Sums	Accounts	Assets at end of year	Credits at end of year	Liabilities at beginning of year	Receipts	Supplied to: Farm	Supplied to: Household	Supplied to: Accessory industries	Supplied to: Private consumption	Working expenses	Sums	Remarks
	104 626.75	Brought forward	79 321.30		16 573 —	86.25	2 137.90	10 —			6 498.30	104 626.75	
		D. LABOUR EXPENSES.											
	2 586 —	*a*) Members of family.									2 586 —	2 586 —	
	2 770.53	*b*) Servants.									2 770.53	2 770.53	
		II. Mixed accounts.											
		1. Field inventory.											
531 —	1 143 —	2. Hay and aftermath in stock.	1 143 —									1 143 —	
	590 —	3. Straw and litter » »	430 —								160 —	590 —	
195.50	897.60	4. Potatoes » »	897.60									897.60	
		5. Roots » »											
		6. Other field produce » »											
	850.60	7. Grain » »	586.70								263.90	850.60	
		8. Farmyard manure » »											
64.90	8 854 —	9. Banking account.		354 —		8 500 —						8 854 —	
	31.75	10. Sundries.	25 —								6.75	31.75	
		III. Accounts of gross produce.											
		1. Sale of grain:											
390.30	390.30	*a*) Wheat. *b*) Rye.				11 —		251 — 128.30				390.30	
		c) Spelt.											
		d) Oats.											
		e) Others.											
		2. Sale of straw.											
90.55	90.55	3. » » potatoes.				90.55						90.55	
568.45	568.45	4. » » other roots and tubers.				462.85		105.60				568.45	
18 —	18 —	5. » » other field produce.				18 —						18 —	
18 —	18 —	6. » » of hay.						18 —				18 —	
		7. » » litter.											
		8. Gross product of fruit growing:											
		a) Fruits, cider, etc.											
602.10	602.10	*b*) Wood and increase.				381.20		220.90				602.10	
3 —	2 447 —	9. Gross produce of vineyard.	2 427 —				20 —					2 447 —	
514.50	6 987.50	10. » » » forest.	6 180 — 375 —			40 —	40 —	352.50				6 987.50	
		11. » » » cattle:											
1 765.85	15 051.85	*a*) Increase without fattening calves.	10 786 —			3 451.85	800 —	14 —				15 051.85	
7 216.95	8 046.95	*b*) Milk and dairy produce.		1 047.70		6 168.40		830.85				8 046.95	
432.90	498.85	*c*) Fattening calves.		57.10		441.75						498.85	
30 —	30 —	*d*) Cartage and sundries.						30 —				30 —	
		12. Gross products of horse stables:											
100 —	1 300 —	*a*) Breeding.	1 300 —									1 300 —	
39 —	39 —	*b*) Cartage and sundries.				39 —						39 —	
3 457.70	4 971.70	13. Gross products of pigs.	1 785 —			2 717.30		469.40				4 971 —	
16 038.70	163 410.48	Carried forward	105 256.60	1 458.80	16 573 —	22 408.15	2 997.90	2 430.55			12 285.48	163 410.48	

Example:

Capital 100 000 frs. at 4 per cent. =	4 000 frs. interest
Net returns	3 500 »
Difference of net returns, or farmer's profit or loss.	500 »
Gross returns.	10 000 »
Difference of net returns in percentage of gross returns	5 per cent.
Average price realized for milk . . .	20 centimes per kg.

Consequently cost of production:

$$20 + \frac{5 \times 0.20}{100} = 20 + 1 = 21 \text{ centimes.}$$

i) *Capital.* — The capital must be shown in its totality and arranged according to its chief component parts (soil, improvements, buildings, forest trees, fruit trees, vines, field inventory or cultivation and manure in fields, live stock, machines and implements, stores and cash) and reduced to the unit of area and to percentages of the whole capital.

j) *Various values.* — Besides the above values a whole series of others can be calculated; thus for instance the household expenses for the day's keep of an adult, the cost of the day's work per grown-up member of the farmer's family or per hired labourer, the value per hectare of the bare soil according to returns, etc. We refer the reader to the reports of the Swiss Peasants' Secretariat (1).

k) *Grouping of the relative data.* — It is desirable that the data should also be divided according to the sizes of the farms, according to the system of farming and according to the general trend of the farms. As for size we recommend the following groups:

Farms	under	3		hectares	(7.4 ac.)
"	between	3	and	5	(7.4-12.35 ac.)
"	"	5	"	10	(12.35-24.7 ac.)
"	"	10	"	15	(24.7-37 ac.)
"	"	15	"	30	(37-74 ac.)
"	"	30	"	70	(74-173 ac.)
"	"	70	"	200	(173-494 ac.)
"	"	200	"	500	(494-1235 ac.)
"	"	500	"	1000	(1235-2470 ac.)
"	above	1000			

As for the systems of farming, no general rules can be given, as conditions vary greatly. The following however may be given as examples:

(1) Untersuchungen betreffend die Rentabilität der schweizerischen Landwirtschaft. — *Landwirtschaftliches Jahrbuch der Schweiz*, 1913.

1. Grazing farms.
2. Three-course rotation with fallow.
3. Improved three-course rotation.
4. Four-couse rotation.
5. Clover and grass leys with alternate cereal crops (Kleegras und Koppel-wirtschaften).
6. Grass farms.
7. Farms with limited live stock.

As for the general trend of the farm, the following may be mentioned:

1. Cattle breeding farms.
2. Cattle fattening farms.
3. Milk farms.
4. Combined animal husbandry farms.
5. Cereal farms.
6. Mixed crops without sugar-beets or potatoes for distillation.
7. Mixed crops with sugar-beets or potatoes for distillation.
8. Sheep farms.
9. Market garden farms.

Here also conditions vary to such an extent that only the main lines can be set down. For the distribution into groups, the chief character is the composition of the gross returns.

VII. Aims to be Attained.

At first it can only be the question of bringing more uniformity into the scientific enquiries on book-keeping, by awakening interest in the subject and by teaching, and this is the object of the present paper. Then the International Institute of Agriculture in Rome could collect all the publications of agricultural book-keeping institutions and point out to the heads of such institutions the advantages of uniform notions and methods.

As final goal, the systematic elaboration of all these results with a view to scientific and practical results should be contemplated. The International Institute in Rome might thus become the central book-keeping office of all civilized peoples. Such an office would not only further the science of economics, but would also render the most valuable service in pointing out the best measures to be adopted for practical farming, in the choice of produce for the market, in determining prices and in agricultural policy in general.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

90 – **Agriculture in New Servia.** — ADAMOVIC, L. in *Österreichische Monatsschrift für den Orient*, Year XXXIX, No. 11, pp. 197-198. Vienna, November 1913.

The extension and importance of the cultivation of the chief crops in the territory recently acquired by Servia: vines, tobacco, melons, cereals, pulse, potatoes, beets, vegetables, hemp and flax; mulberry plantations for silkworm rearing, poppy growing for opium manufacture, sesame cultivation, chestnut plantations. The chief feature as regards live stock is the large number of buffaloes kept. Bee-keeping is widespread.

91 – **Agriculture in Uele (Belgian Congo).** — GOFFINET, J. in *Bulletin agricole du Congo belge*, Vol. IV, No. 3, pp. 587-609 + 1 map and 27 figs. Brussels, September 1913.

The old district of Uele consists of the basin of the river bearing the same name and of its numerous tributaries as well as that of the river Bomu with its tributary the Bili, and the basins of the Likati and Rubi rivers.

In its south-western part the agricultural district of Uele is decidedly equatorial while to the north-east its character is subtropical. The division between these two belts is marked by the rivers Bomokandi, Uele and Bili.

The swamps are relatively of small extent, so that mosquitoes are less numerous than in most of the rest of the colony.

The natives, who are considered the strongest of the colony, are very numerous. They are peaceful and frequently well organized; they cultivate the land and are hunters or fishermen. Labour is abundant and easily recruited.

Crops. — Bananas, manioc, maize, sweet potatoes, ground nuts, mountain rice, and sugarcane are the most widely spread crops in the forest region (equatorial belt), whilst on the savannahs, wire grass, sorghum, sesame and haricots, with maize, manioc and sweet potatoes, are more cultivated.

The only system of fertilizing practised is by fallowing, which allows the forest or the grasses of the bush to grow again and enrich the soil with their detritus.

With the exception of palm and sesame oils, which are objects of trade among peoples sometimes distant from each other, agricultural produce is consumed on the spot or not far off.

Live stock breeding. — Cattle is raised only in the eastern extremity of the Uele towards the summits which mark the watershed between the Congo and the Nile.

Prices of domestic animals.

Cattle	8*s* to £ 2
Horses	about £ 40
Asses	£ 6 to 16
Mules	£ 12 to 28
Sheep	4*s* to £ 1
Fowls	up to 10*d* and 1*s* 8*d*.

The domestication of elephants gives very satisfactory results at Api.

92 - **Recent Research on the Causes of Pellagra and New Views on its Cure.** — 1. ALESSANDRINI, GIULIO. Sulla pellagra in Italia. Osservazioni epidemiologiche. — (Reprinted from *Annali d'Igiene Sperimentale*, Vol. XX, New Series, Part IV), pp. 49, Turin, 1910. — 2. ID. and SCALA, A. Contributo nuovo alla etiologia e patogenesi della pellagra. (Reprinted from *Il Policlinico*, Sezione pratica, Year 1913) pp. 24. Rome, 1913. — 3. Pellagra triste.... Nuovi studi sulle cause e nuovi orientamenti per la cura. — *La nuova Agricoltura del Lazio*, Year I, No. 14, pp. 109-111. Rome, July 16, 1913. RURAL HYGIENE.

Pellagra in Italy. — The Italian provinces infected by pellagra number 23; the deaths due to this disease are estimated at 4000 per annum, while several hundreds of pellagrins are admitted every year to the asylums for the insane. According to the official census, the number of persons suffering from pellagra was 33 869 in 1910, as against 104 067 in 1881. In Latium pellagra exists to a very limited extent: according to a subcommittee of the provincial committee for the study of pellagra, there were in the first half of 1913, 46 cases (including doubtful ones), distributed in 12 communes. But whilst in Italy on the whole the disease is gradually decreasing, in Latium pellagra has always been stationary, both in the number of patients and in the localities in which the disease appeared.

Connection between pellagra and agriculture. Theories on the etiology of pellagra. — According to the most generally accepted opinion, the disease is especially rife among rural populations, and some believe that it attacks cattle and other domestic animals.

Pellagra has been attributed in turn to the following specific causes:

1. The use of damaged maize as food (the maize theory of Lombroso and his school); on this has been based, in Italy, the prevention and cure of the disease and the legislation concerning it (Law of July 21, 1912, on the prevention and cure of pellagra).

2. A special infection caused by a germ (*Streptobacillus pellagrae*), which is believed to develop on spoiled maize (theory of Professor Guido Tizzoni).

3. Inoculations by special Diptera (sandflies), of the family Simulidae, allied to mosquitoes and living in running waters (Dr. Sambon's theory).

4. *Drinking the water of certain localities* (Alessandrini and Scala's Theory). This theory has been corroborated by experiments carried out by Professors Alessandrini and Scala at the Institute of Hygiene at the University of Rome, under the auspices of Prof. Celli, Director of the Institute.

The Alessandrini-Scala theory. — The researches conducted by Alessandrini since 1909 lead to the conclusion that pellagra is a *sharply localized* disease and that it is contracted in those determined districts in which the water usually drunk springs from clay soils or flows and stagnates upon them. He supposed at first that the specific cause was some parasite living in such waters and belonging to the Filaria group. But the first experiments made according to this hypothesis, caused it to be rejected, but at the same time confirmed that the disease was due to the water. Prof. Scala then supposed the pathological agent contained in the water to be of mineral origin, and numerous experiments carried out on rabbits, guinea-pigs, dogs and monkeys confirmed the writers in their opinion that pellagra is the effect of a chronic poisoning due to silica in colloidal solution in waters of a certain composition.

"Clay, which is a silicate of alumina, is the original cause of the disease, as rainwater acting upon it causes a hydrolysis, from which both silicic acid and hydrate of alumina, according to the conditions under which hydrolysis takes place, may pass into the water in colloidal form. However, as there is incompatibility between colloidal silica and aluminia and they precipitate each other, there remains in the water only the excess of silica over that quantity required to precipitate the alumina; part of the colloidal compound silica-alumina, which is not to be confused with silicate of alumina, deposits, while the rest remains in extremely fine colloidal suspension, causing that persistent opalescence frequently observed in the water drunk by pellagrins. On entering the human organism, the silica causes a retention of sodium chloride, which, in contact with the protein of the tissues, gives rise to the formation of hydrochloric acid, and consequently to a true poisoning by a mineral acid".

Not all waters containing silica cause pellagra, because, as is well known, *colloidal silica* may be influenced by some neutral salts or mixtures of these present in the water, which may prevent, alter, or in some cases increase, the injurious effects of silica. By means of numerous experiments, the writers found that the salts which act beneficially are the alkaline carbonates in general and especially that of lime, which exists or may exist in drinking water.

New prevention and cure of pellagra. — As pellagra is the consequence of an excess of mineral acid in the system, the cure can only consist in its neutralization by means of an alcaline solution. The writers used solutions

of trisodium citrate on diseased persons and animals; this treatment rapidly proved beneficial. Admitting that colloidal silica may readily be rendered harmless by carbonate of lime, the prevention of pellagra consists simply in having an excess of carbonate of lime, as small pebbles, always present in the waters causing the disease.

At the same time the necessity of continuing the campaign against the use of damaged maize and its products does not cease, because this food is always one of the chief predisposing causes.

The Roman committee on pellagra has resolved to experiment on a large scale the new method of prevention and cure in some of the most important centres of pellagra in Latium.

93 - **The Imperial Japanese Tohoku University at Sapporo (Island of Yesso).** — MÜLLER, MAX in *Deutsche Landwirtschaftliche Presse*, Year XXXX, No. 88, pp. 1047-1049; No. 89, pp. 1060-1062. Berlin, November 1 and 5, 1913.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY.

The Agricultural College at Sapporo, which was founded in 1876, was declared on September 1, 1907, to be a branch of the Sendai University. It comprises four separate three-year courses for agriculture, agricultural chemistry, forestry and animal husbandry. Schools of fishery, civil engineering, practical agriculture and practical forestry are attached to the institution, as well as a so-called preparatory school, in which students are prepared by a three- years' course of studies for the University. It possesses two university farms, 185 and 272 acres in extent, of which one is devoted to the experiments and practical work of the students, and the other is a model farm. Besides the above, the institution has also a botanical garden of about 27 acres in extent and can avail itself of 127 244 acres of forest.

In the University itself there are 23 professors and 25 assistant professors, and in the schools attached to it about 50 lecturers. The total number of students last year was 898, *viz.* 211 at the University, 297 at the preparatory school and 390 at the other schools. As university students only the young men possessing the leaving certificate of the preparatory schools are admitted. For admittance to the preparatory and other schools the leaving certificate of a five-years' medium school is required.

The writer describes the situation of the various school buildings, and discusses the three-years' curriculum of the preparatory and of the practical agricultural school, the six to eight-years' curriculum of the elementary schools and the five-years' one of the medium schools. He concludes with some interesting data on Japanese student life.

94 - **The Rural Travelling Housekeeping Schools in Prussia in 1912.** — *Zeitschrift für das Ländliche Fortbildungsschulwesen in Preussen*, Year 5, Part 2, pp. 47-61. Berlin, November 1913.

In 1912 there were in Prussia 250 rural travelling housekeeping schools in full working order, divided amongst 243 Districts ("Landkreise").

The numbers in the various provinces were as follows: East Prussia 11, West Prussia 3, Brandenburg 21, Pomerania 17, Posen 34, Silesia 37, Saxony 13, Schleswig-Holstein and the Hohenzollern territory 1 each, Hanover 28, Westphalia 12, Hesse-Nassau 21, the Rhine Province 51.

A total of 817 courses were held as against 564 in the previous year. The number of the eight-weeks' courses has risen from 407 to 638, and that of the longer from 67 to 103, while the courses of less than eight weeks' duration have fallen from 90 to 76. The 817 courses were attended by 13 581 girls and young women who had left school, an average of 21.3 per course. More than half of these (53 per cent.) came from the peasant classes, 20 per cent. were the daughters of country tradesmen, while 15 per cent. of the scholars belonged to the agricultural labourers' class and 12 per cent. to the professional and similar classes.

Of the 250 schools, 168 were supported by the District Communal Associations, 5 of them being under the management of Womens' Unions, 65 schools were entirely managed by Womens' Unions and 17 by private individuals and others. The whole maintenance cost amounted to £29 304, of which £11 027 was contributed by scholars' fees and nearly half the remainder by the Districts.

AGRICULTURAL SHOWS AND CONGRESSES.

95 - **Agricultural Shows.**

Belgium.

1914. March. Brussels. — Exhibition of agriculture and agricultural machines and implements.

Denmark.

1914. March 30-31. Copenhagen, Grundtvigs Hus. — Seventeenth dairy show, organized by the Seeland-Laaland-Falster Agricultural Society and the Danish Dairy Society.

France.

1914. March. Carcassonne (Aude). — Competition for vine-mildew fungicides, arranged by the "Société centrale d'agriculture de l'Aude". Offices: rue et hôtel Courtjaire, Carcassonne.

March 15-30. Grasse (Alpes-Maritimes). — Agricultural, horticultural and industrial exhibition. Includes the following classes: 1) Perfumery; 2) Olive oil, other olive products, apparatus and accessories for preparation of olive oil; 3) Horticultural produce and materials; 4) Produce of other branches of agriculture and materials.

May 20-27. Paris, Cours la Reine. — Spring horticultural show held by the "Societé Nationale d'Horticulture de France".

May 21-24. Angers, Place de la Rochefoucault. — Second triennial show held by the Maine-Anjou Cattle Breeders' Society. Sec: M. Delhommeau, Avenue Carnot, Château Gontier, Mayenne.

May 29-June 2. Lyons. — International Poultry Show, in connection with the Urban Show. A Poultry Congress will also be held. Address: 3 Place des Cordeliers, Lyons.

Germany.

1914. June 9-Sept. 6. Minden (Westphalia). — Agricultural and horticultural show annexed to the Arts and Industries Exhibition.

Russia.

1915. St. Petersburg. — Great international exhibition of the cheese industry, including all forms of utilization of milk.

United Kingdom.

1914. April 14-17. Dublin, Ball's Bridge. — Spring show of the Royal Dublin Society. Address: Agricultural Superintendent, Leinster House, Dublin.

Oct. 20-23. London, Royal Agricultural Hall. — Dairy show. Sec: F. E. Hardcastle, 28 Russell Square, London, W. C.

Oct. 31-Nov. 6. London, Royal Agricultural Hall. — Brewers' show.

Nov. 28-30 — Dec. 1-3, Birmingham, Bingley Hall. — Cattle and Poultry Show. Sec.: W. H. Lythall, Bingley Hall, Birmingham.

96 - **Agricultural Congresses.**

France.

1914. May 22. Paris. — Horticultural Congress, organized by the "Société Nationale d'Horticulture", 84 rue de Grenelle, Paris.

CROPS AND CULTIVATION.

97 - **Temperature Coefficients in Plant Geography and Climatology.** — LIVINGSTON, B. E. and LIVINGSTON, G. J. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 349-375 + 3 figs. Chicago, November 1913.

This paper deals with the methods of interpreting climatic temperature data for phytogeographical purposes. Temperature and its influence on plant growth vary only with respect to intensity and duration. As the controlling climatic conditions are only effective during the season of active growth, the duration factor is estimated as the time between the last killing frost of spring and the first frost of autumn. The temperature efficiences for growth corresponding to the normal daily temperature means are deduced from the assumption that physiological processes conform to the Van't Hoff-Arhenius principle and that the rate of growth has a temperature coefficient of 2 for each 10° C. of variation within the ordinary limits of environmental temperatures. Thus, if the rate of growth is unity at 40° F. and it doubles for each rise of 10° C. (or 18° F.) above this, and if t rep esents the normal daily mean temperature (F) then μ, the corresponding temperature efficiency index, is given by the formula —

The summations of the normal daily mean temperature and of the daily temperature efficiencies of various stations throughout the United States were indicated on charts. The positions of the isoclimatic lines thus obtained show a marked similarity. Therefore, for most of the area of the United States the two methods of estimating temperature effectiveness for plant growth give results which agree within the limits of 5 per cent. This similarity, however, is only superficial and roughly approximate, since the ratios of the two are not constant, but range in magnitude from 7.49 to 10.44.

The ratios between these two series of indices were indicated on another map and the positions of their isoclimatic lines suggest that these ratios are a measure of some as yet unknown climatic characteristic.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

98 — **Effect of the Nature and of the Water Content of Soils upon their Nitrogen Content** (Mitteilung aus der agrikultur chem. Versuchsstation in Halle a. S.). — MÜNTER, F. (author of Report) and ROBSON, W. P. in *Centralblatt für Bakteriologie*, etc. II Abt., Vol. 39, Nos. 15-17, pp. 419-440. Jena, November 29, 1913.

The writers set themselves the following problems:

1. How do organic nitrogenous manures behave in different soils with various water content?

2. How does sulphate of ammonia behave in similar conditions?

3. Under what conditions and in how much time does the optimum formation of nitrates take place?

4. At what degree of humidity do losses of nitrogen occur?

5. What is the action of organic sources of carbon upon the nitrogen content when nitrate and sulphate of ammonia are added?

With the object of answering the above questions, they conducted culture experiments in pots in the laboratory and with applications of nitrogenous manures at the rate of upwards of 2 tons per acre, that is in quantities not practically applicable. The experiments were carried out on three kinds of soil containing the following quantities of nitrogen:

Soil	Nitrogen			
	nitric	soluble ammoniacal	total ammoniacal	total
	per cent.	per cent.	per cent.	per cent.
Sandy	0.00103	—	0.00057	0.09148
Loamy	0.00654	—	0.00119	0.15977
Clayey	0.00152	—	0.00044	0.17223

The degrees of moisture experimented with were respectively 6, 12 and 18 per cent. for the sandy soil; 8, 16 and 24 for the loam; 8, 18 and 28 for the clay. The determinations were made after three, six and twelve weeks.

It appears that organic compounds of nitrogen decompose more intensely in sandy soils than in loams or clays when the degree of moisture is low; if this increases the difference tends to diminish. On the contrary the transformation of sulphate of ammonia into nitrates takes place all the more rapidly the higher the water content in sandy soils as well as in loams and clays; there is, however, a difference in the fact that in loam and clay the biochemical activity is greater, while with the lower degrees of moisture the transformations in sandy soils begin with more energy. It appears consequently that 6 per cent. of moisture in sandy soil is more favourable to bacterial activity than the 8 per cent. of clay soil.

The ammoniacal nitrogen which is formed from horn meal disappears rapidly in the presence of much moisture in the various soils; on the contrary with a low degree of moisture it keeps longer, and the maximum is sooner reached the lighter the soil. Thus in sandy soils after three weeks it was 36.68

per cent., in loam after six weeks it was 41.28 per cent. and in clay after twelve weeks only 13.37 per cent. of the nitrogen that was applied. The absorption of ammoniacal salts is greater the heavier the soil. This must be especially noticeable in dry years. After 12 weeks the sandy soil can transform 97 per cent. of the sulphate of ammonia added to it, while loams and clays can transform up to 100 per cent., which however is not all found under the nitric form. With horn meal the formation of nitrates proceeded most favourably in sandy soils; only with medium water content did the better soils show similar conditions. The greatest quantities of nitrates are produced in all soils by sulphate of ammonia, with the exception of dry sandy soil and, in the case of much moisture, during the first weeks.

In general the most intense formation of nitrates with the various soils occurs between the third and the sixth week after the manure has been given; only in the clay soil with the greatest moisture the maximum intensity of transformation appeared during the first three weeks. At the time of the greatest content of nitrate, that is after six weeks with medium moisture, the following were the proportions of easily assimilable nitrogen in percentages of the nitrogen applied:

Manure	Sandy soil		Loam		Clay soil	
	nitric N.	ammoniacal N.	nitric N.	ammoniacal N.	nitric N.	ammoniacal N.
Sulphate of ammonia	60.07	28.51	78.83	6.67	78.17	5.48
Horn meal	49.15	0.00	58.71	0.69	57.24	0.00

Thus, by giving mineral nitrogen fertilizers the plants have greater quantities of plant food at their disposal than when organic manures are given.

A considerable quantity of nitrogen was freed only with the highest water content, with sulphate of ammonia in loamy soil to the extent of 19.8 per cent. of the added ammoniacal nitrogen at the end of the experiment, and with horn meal 32.2 per cent. in loam and 32.7 per cent. in clay.

A very heavy addition of organic matter under the form of sugar reduced the soluble nitrogen compounds to such an extent as to cause a lack of nitrogen for the plants. Thus the ammoniacal nitrogen added to the three soils disappears more rapidly in the presence of sugar, but without a corresponding increase of nitrate, the nitrogen that disappears being taken up by the bacteria.

By the addition of sugar to the ammoniacal manure, with medium moisture and after six weeks, the content of nitric nitrogen diminished in the sandy soil from 57.52 to 50.87 per cent., in the loam from 58.10 to 52.97 per cent. and in the clay soil from 70.92 to 61.62 per cent. Consequently the nitrogen that was fixed and subsequently removed on the addition of sugar increased in the sandy soil from 18.18 to 26.18 per cent., in the loam from 22.32 to 43.20 and in the clay from 29.08 to 38.38 per cent.

The formation of proteids was also increased by the addition of organic matter, and the loss of free nitrogen in the sandy soil was 11.43 and in the loam 14.67 per cent. of the nitrogen applied, while no loss was observed in the clay soil.

Lastly no fixation of free nitrogen could be proved.

99 — **The Displacement of Potash in Felspar by Certain Substances Employed as Fertilizers.**—*Comptes Rendus des Séances de l'Académie des Sciences,* Vol. 157, No. 19, pp. 856-858. Paris, November 10, 1913.

The writer has resumed his investigations into the double decomposition which occurs when felspar rock is triturated in contact with solutions of certain substances. For this purpose a microcline of Utöe of the following composition was used:

silica	66.03 per cent.
alumina	19.12 » »
potash	11.38 » »
soda	2.96 » »
lime	0.22 » »
ferric oxide . . .	traces
magnesia	»

This was ground and passed through a sieve with 70 holes to the square inch. Ten to twenty gms. were put into a mortar and subjected to mechanical trituration for 130 hours in the presence of 100 cc. of water to which certain substances had been added. The liquid was then filtered through a collodion filter and analysed, with the results given in the accompanying table. It should be noted that besides the action of the added substances the felspar is subjected to the action of water and atmospheric carbon dioxide in every case:

Amount of felspar employed: gms.	Added substance	Potash dissolved		
		gms.	per cent. of the felspar	per cent. of the potash in the felspar
10	—	0.0112	0.112	0.98
10	—	0.0139	0.139	1.22
20	1 gm. sodium chloride	0.0741	0.37	3.25
15	» calcium carbonate	0.0407	0.27	2.38
15	» tricalcic phosphate	0.0336	0.22	1.96
15	» monocalcic »	0.0667	0.44	3.90
15	» sodium nitrate	0.0548	0.36	3.21
15	» ammonium sulphate	0.1260	0.84	7.38
15	» calcium »	0.0552	0.36	3.23

Clearly the added substances have in every case caused the displacement of a larger quantity of potash than was given up to the pure water.

Now substances dissolved in the soil water are derived from the reaction of water, more or less charged with carbon dioxide, on the rock particles of the soil itself, the ease with which the particles are attacked increasing as their size diminishes. But this solvent power of water is further increased by the presence of other substances in solution, some of which, such as lime and gypsum, are normally present in soils, while others are added as fertilizers. Therefore the formation of the so-called " soil solutions " may be attributed to contact actions similar to the ones discussed above, where the intimacy of the contact was greatly accentuated owing to the experimental conditions.

With regard to individual results: soda, in the form of both nitrate and chloride, has a very distinct action and displaces an almost identical quantity of potash in both cases. It should be noted further that the less soluble salts, such as lime and tricalcic phosphate, whose solubility increases with the carbon dioxide tension of the soil atmosphere, displace very perceptible quantities of potash. Calcium sulphate and the very soluble monocalcic phosphate react more strongly, but the effect of the latter is limited by retrogressive phenomena. Ammonium sulphate is the most active salt of all, as has already been noted by previous observers.

In conclusion, double decomposition plays an important part in the formation of nutritive soil solutions when the mineral elements in the soil and the added fertilizing material are reduced to a sufficiently fine condition for them to react easily on one another.

100 - **Studies es on Acid Soils of Porto Rico.** - LOEW, O. - *Porto Rico Agricultural Experiment Station, Bulletin* No. 13, pp. 23. Washington, October 1913.

An examination of certain clay soils in Porto Rico which owe their acidity to the nature of the clay rather than to the presence of organic acids. The soils were subjected to both chemical and bacteriological tests, and the effect of lime was also investigated in some cases.

101 - **Bright Virginia Tobacco Soils.** — BLACKSHAW, G. N. in *The Rhodesia Agricultural Journal*, Vol. XI, No. 2, pp. 209-212. Salisbury, Rhodesia, December 1913.

A comparison of the mechanical analyses of typical tobacco soils from Virginia and North Carolina with those in Rhodesia, showing that the latter are lighter in character, whether derived from granite or from sandstone.

102 - **Sprinkling the Ground in Farming and Gardening.** — STRECKER, in *Deutsche Landwirtschaftliche Presse*, Year 40, No. 85, p. 1013. Berlin, October 22, 1913.

PERMANENT IMPROVEMENTS DRAINAGE AND IRRIGATION

The writer describes some models of his sprinkling system. These were exhibited at the International Building Construction Exhibition at Leipzig in 1913 and are protected by patents. After dealing with their importance, the writer gives a description and illustrations of the different systems, which are simple, practical and inexpensive.

MANURES AND MANURING

103 – **The Influence of Manuring upon the Composition of Soils and their Suitableness for Certain Crops.** (Mitt. aus dem Institut für Boden-und Pflanzenbaulehre der Kgl. landw. Akademie zu Bonn-Poppelsdorf). — MAUSBERG, A. in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 1, pp. 29-101. Berlin, 1913.

On the basis of the continuous manuring experiments commenced in 1895 in the experimental field of the Bonn-Poppelsdorf Agricultural Academy, the writer makes some remarks on the connection between manuring and the conditions and fertility of the soil. The observations refer to a five-year's rotation (1907-11) on a loam soil, physically well constituted, but but relatively poor in plant food; the manure given varied on the fourteen plots from a complete manure (nitrate of soda 2.4 cwt., kainit 6.4 cwt., double superphosphate, containing 40 per cent. P_2O_5 1.6 cwt., quicklime 7.8 cwt., calcinated magnesia 3.2 cwt. per acre per annum) to none at all. Thus the plots were: 1) unmanured, 2) with nitrate of soda, 3) with sulphate of ammonia, 4) with potash, 5) with phosphoric acid, 6) with lime, 7) with magnesia, 8) with complete manure, 9) do. without nitrogen, 10) do. with sulphate of ammonia, 11) do. without potash, 12) do. without phosphoric acid, 13) do. without lime, 14) do. with mixed manures, that is farmyard manure with phosphoric acid and potash; in some cases nitrogen was given under the form of dried blood.

The connection between the crops, the conditions of the soil and the manures are summarized in Table I.

TABLE I.

Crop in rotation	Effect observed					Superiority of nitrogenous manure	Treatment which yielded the maximum crop.
	of nitrogen	of potash	of phosphoric acid	of the reaction of the soil	of the favourable structure of the soil		
Winter rye	slight	marked	slight	generally nil	uncertain	nitrate of soda, slight	complete or mixed manure
Oats	strong	strong	marked	do.	generally nil.	nitrate of soda, marked	complete manure, alone
Peas	—	strong	slight	marked	do.	—	only with contemporaneous application of potash and lime
Potatoes	marked	very strong	slight	generally nil.	do.	sulphate of ammonia, marked, especially for quality	mixed manure
Sugar beets	strong	strong	slight	strong	strong	nitrate of soda, marked	complete manure, easily assimilable nitrogen with sufficient potash with high alkalinity and favourable structure of soil.

CONCLUSIONS.

1. *Winter rye* proved very thrifty from every point of view; abundant manuring gives very low profits; loose soils are more favourable than compact ones; the soil reaction has no effect upon rye.

2. *Oats* require especially easily assimilable nitrogen (nitrate of soda); after nitrogen, the development depends to a remarkable extent upon a sufficient supply of potash; there are no observations on the connection between yield and looseness and reaction of the soil.

3. *Peas:* good crops are obtained only by the contemporaneous use of potash and lime; deficiency of either causes the same diminution of crop as the want of both.

4. *Potatoes:* the character of typical potash plants is confirmed, as of all the fertilizing elements potash acts with the greatest energy on the increase of the crop, and as soon as it is lacking the yield falls off, even if the other elements be present in abundance. Sulphate of ammonia behaves better than nitrate of soda. The reaction of the soil exerts no action; consequently when the other elements are present, especially magnesia, the lack of lime does not cause any decrease of crop; the heaviest crops have been obtained by 8 tons per acre of stable manure assisted by phosphatic and potash manures, notwithstanding an insufficient alkalinity of the plot.

5. *Sugar beets* feel the want of any one or two of the following conditions:

a) easily assimilable nitrogen,
b) sufficient potash,
c) increased alkalinity and favourable texture of the soil.

Beets differ from potatoes in many points: thus, though they require potash manures, they feel the lack of them less than do potatoes; beets also react markedly to lack of lime, even when supplied with magnesia; and whilst potatoes prefer sulphate of ammonia, beets prefer nitrate of soda; further, manures injure the starch content of potatoes more than the sugar content of beets, and while the use of potash salts deteriorates the quality of potatoes, it improves that of beets; lastly, for both these crops phosphoric acid produces only an insignificant increase of yield, whilst sulphate of ammonia exerts a favourable influence on the formation of carbohydrates.

104 – **Results obtained at the Tjikeumeuh Experiment Garden with various Green Manures.** — VAN HELTEN, W. M. in *Mededeelingen uit den Cultuurtuin*, No. 1, 17 pages + 9 plates. Buitenzorg, 1913.

The plants with which experiments were made at Tijkeumeuh (Buitenzorg) were divided into four groups according to the most suitable manner of utilizing each kind.

I. — *Green manure plants sown between the rows of the main crop, and the leaves of which may be cut regularly.*

Plant	Qualities	Defects
Tephrosia candida	Lives long, leaves abundant, decomposition slow *	
Clitoria cajanifolia	do	
Leucaena glauca	Lives very long, abundant production of eeed, stands slight shade.	Very rapid decomposition.
Tephrosia hookeriana var. *amoena*	Adapts itself to poor soils.	
Desmodium gyroides	Lives long.	Numerous buds fail to grow.
Indigofera Anil	Lives long, leaves fairly abundant, large production of seed.	Rapid decomposition.

* The slowness of decomposition allows a plant to be used as mulch.

II. — *Green manure plants which may be worked in before planting the main crop, or which may be used as I, but yielding only one cut.*

Plant	Qualities	Defects
Phaseolus calcaratus	Covers the soil rapidly, leaves abundant.	Lives only one year.
Pueraria phaseoloides	Do	Attacked by flea-beetles.
Crotalaria incana	—	Attacked by several insects, become bushy.
» *striata*	—	
» *laburnifolia*	Leaves abundant.	The stalk becomes woody.
» *quinquefolia*	Rapid growth, gives in a short time a large quantity of leaves, does not become woody.	Destroyed by insects.
» *alata*	Cover the soil rapidly, do not become woody; *ferruginea* has a special abundance of leaves.	Destroyed by insects.
» *ferruginea*		
» *juncea*	Rapid growth on good soil.	Must be thickly sown, lives only 6 months.
Vigna sinensis	Grows rapidly, leaves abundant.	—
Cassia mimosoides	Rapid growth, great quantity of seed.	Must be thickly sown, lives only 6 months.
» *patellaria*	Do	
Canavalia ensiformis	Adapts itself to very bad soils.	—

III. — *Climbing green manure plants which can be used as I.*

Plants	Qualities	Defects
Centrosema Plumieri	Luxurious growth, throws out roots at every node, does not climb much, yields much seed, even on the ground; can live three years.	Climbs a little, so the main crops must be disengaged every six weeks.

IV. — *Climbing green manure plants which can be used only by working them in before planting the main crop.*

Mucuna sp. with violet flowers and white seeds	Luxurious growth.	Attacked by disease and dies in 9 months.
Phaseolus lunatus	Lives 2 years.	

The writer gives the following data on *Tephrosia:*

	Yield of green leaves per acre	Quantity of seed required per acre
T. candida	8 480 lbs.	112 lbs.
T. hookeriana	7 580 »	121 »
T. Vogelii	8 030 »	136 »

105 - **Comparative Manuring Experiments with Calcium Cyanamide, Nitrogen Lime, Nitrate of Soda and Sulphate of Ammonia on Sandy and Peaty Soils.** — TACKE, BR. and BRÜNE, FR. in Die *landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIII, Part I-II, pp. 1-100. Berlin, 1913. (1).

In order to throw further light on the results previously obtained by other experimenters, some experiments on the use of calcium cyanamide (Kalkstickstoff) and nitrogen lime (Stickstoff-kalk) in comparison with nitrate of soda and sulphate of ammonia, were conducted on sandy and peaty soils by the Bremen Experiment Station for Moor Cultivation.

The results for the years in which the nitrogenous manures had a fair or good effect are given in Tables I and II.

(1) See No. 491, *B* March 1912. (*Ed.*)

TABLE I. — *Comparative effects of the various nitrogenous manures according to the crops.*

Crops	Relative yields: crop of grain and straw or tubers due to nitrate of soda = 100.						
	Nitrate of soda	Sulphate of ammonia	Cyanamide or nitrogen lime; when given.				
			3 to 4 weeks before sowing	2 weeks before sowing	1 week before sowing	with seed	as top-dressing
I. *Sandy soils.*							
Rye: average . . . grain . . .	100	73	—	—	—	—	67
Rye: average . . . straw . . .	100	82	—	—	—	—	54
Oats: average . . . grain . . .	100	71	114	62	95	44	77
Oats: average . . . straw . . .	100	82	91	60	66	46	82
Potatoes: average, tubers . . .	100	—	100	75	88	107	95
Total average: grain or tubers . . .	100	72	107	69	92	76	80
				89			
					85		
Total average: straw.	100	82	91	60	66	46	68

			Cyanamide			Nitrogen lime	
			3 weeks before sowing	with seed	as top-dressing	with seed	as top-dressing
II. *Peaty soils.*							
Rye: average . . . grain . . .	100	92	—	—	66	—	66
Rye: average . . . straw . . .	100	103	—	—	64	—	68
Oats: average. . . grain . . .	100	85	69	67	82	33	83
Oats: average. . . straw. . .	100	88	63	55	72	27	92
Potatoes: average, tubers . . .	100	—	56	52	83	—	—
Total average: grain or tubers. . . .	100	89	63	60	77	33	75
				67		54	
Total average: straw.	100	96	63	55	68	27	80
				62		54	

TABLE II. — *Utilization by cereals of the nitrogen of the various fertilizers.*

Crops.	Amount taken up by crops on 100 parts of nitrogen given			
	Nitrate of soda	Sulphate of ammonia	Cyanamide	Nitrogen lime
I. *Sandy soils*				
Rye : average	51	29	30	30
Oats »	56	54	30	26
Total »	*54* (**100**)	*42* (**78**)	*30* (**56**)	*28* (**52**)
			(**54**)	
II. *Peaty soils*				
Rye : average	42	42	23	37
Oats »	55	55	32	37
Total »	*49* (**100**)	*49* (**100**)	*28* (**57**)	*37* (**76**)
			(**67**)	

As for the relative action of cyanamide compared with nitrogen lime, the results on sandy soils are given in Table III.

Number of experi-ment	Year in which experiment was made	Dressing of nitrogen in manure lbs. per acre	Crops	Increase of crop over non-nitrogenous manure lbs. per acre			
				Cyanamide		Nitrogen lime	
				grain	straw	grain	straw
1	1908-09	40	Rye	854	1050	727	1022
1	1910	40	Oats	167	282	184	385
1	1910-11	40	Rye	621	834	539	811
			Average . . .	*547*	*722*	*484*	*740*
			Relative effect . .	**100**	**100**	**88**	**92**

CONCLUSIONS.

I. The opinion of several experimenters that the effects of nitrogen lime prepared by the Polzenius process were the same as those of calcium cyanamide prepared by Frank's process, seems to be confirmed as to sandy soils

by the present experiments. On peaty soils however it appears that such is not the case, for the average effect of nitrogen lime was only 91 per cent. of that of calcium cyanamide; however within the individual experiments the deviations in the results disappear more or less completely and nitrogen lime shows an even better utilization of nitrogen; nevertheless it is problable that the chloride of lime which enters into the preparation of nitrogen lime is not without effect on acid soils such as peats, and is liable under certain circumstances to be injurious.

II. In order to obtain the best possible results in sandy and peaty soils with cyanamide and nitrogen lime, it is necessary according to the above experiments to pay attention to the following points:

a) Calcium cyanamide must never be spread together with the seed as it injures its germinative energy; oats appear the most sensitive to this action, especially in sandy soils, and in this case the effect of cyanamide is only 44 per cent. of that of nitrate of soda.

b) As a top-dressing, calcium cyanamide does not give the best results, especially with rye, on either sandy or peaty soils; in the case of a late top-dressing on rye, where the effect of nitrate of soda was taken as equal to 100, the effect of calcium cyanamide was 67 on sandy soil, and 66 on peaty soil. On oats and potatoes the effect was better, being 80 per cent. on sandy soil and 82 per cent. on peaty soil of the effect of nitrate of soda, a little less than when it was applied some time before sowing.

c) The best results with cyanamide were always observed when it was given some time before sowing, especially in sandy soil, when it averaged 89 per cent. of nitrate of soda. On giving cyanamide eight days before sowing and harrowing it in immediately after spreading, no injurious action on the germinative energy of the seeds is noticed; this short time seems to be enough for the processes of transformation which take place in contact with the moist soil to proceed sufficiently to cause the toxic character of the initial products of decomposition to disappear completely.

d) The utilization by plants of the nitrogen in cyanamide is inferior to that of the nitrogen in sulphate of ammonia and in nitrate of soda; taking the utilized nitrogen in the latter as 100, that in cyanamide averages 54 in sandy soils, and 67 in peat soils.

III. Whilst it appears to be confirmed that cyanamide opportunely and suitably used is an efficient manure for sandy and peaty soils, farmers must consider before using it extensively if this manure is offered at a suitable price, because, owing to the superiority of nitric nitrogen, this element in cyanamide must be quoted at a correspondingly lower price.

106 - **Nitrogenous Fertilizers Obtainable in the United States.** (1) - TURRENTINE, J. W. — *Bulletin of the U. S. Department of Agriculture*, No. 37, *Contribution from the Bureau of Soils*. Washington, December 8, 1913.

The following materials constitute the present sources of nitrogenous fertilizers in the United States:

(1) See INSTITUT INTERNATIONAL D'AGRICULTURE, *Production et consommation des engrais chimique dans le monde*.

Artificial nitrates (calcium and ammonium).
Nitrate of soda.
Sulphate of ammonia.
Fish scrap or guano.
Tankage or slaughter-house refuse.
Dried blood.
Cottonseed meal.

The home production in 1912 was as follows:

Sulphate of ammonia	138 400 tons (155 000 short tons) (1)
Calcium cyanamide	4 000 »
Tankage	222 535 »
Dried blood	79 794 »

12 000 tons of cyanamide were also produced at Niagara Falls, Ontario, Canada.

The figures for tankage and dried blood are calculated from the total slaughter of live stock in the country, but only the larger slaughter-houses utilize their waste products to the best advantage.

To the production must be added the imports, as follows:

518 613	tons of nitrate of soda	(1911)
2 302	» » lime	»
60 000	» sulphate of ammonia	(1912)

The consumption during the same period is given in the following table.

Sources of Nitrogen used in Mixed Fertilizers in the United States.

Material	Amount used	Nitrogen content	Nitrogen yielded by fertilizer
	tons	per cent.	tons
Sulphate of ammonia (2)	198 400	19.75	—
Nitrate of soda	70 000	15.5	10 850
» lime	—	12.75	—
Calcium cyanamide	11 264	18.0	2 028
Cottonseed meal	—	6.5	—
Tankage: Bu. of Animal Industry . .	161 950	6.5	10 527
Tankage: Lodge	99 324	6.5	6 456
Fish scrap	70 000	9.0	6 300
Dried blood: Bu. of Animal Industry . .	57 473	11.0	6 322
Dried blood: Lodge	37 710	11.0	4 148

(1) According to the *American Coal Products Co.*, New York, the production in 1912 was 147 000 tons. *(Ed.)*.

(2) According to the *American Coal Products Co.*, New York, this figure should be 207 000 tons. *(Ed.)*.

The figures for sulphate of ammonia may be too large, as they include the proportion of the substance which was employed otherwise than as a fertilizer. Those for nitrate of soda were obtained by taking 13 per cent. of the total imports, that being the amount which is attributed to fertilizers; and this estimate may be somewhat low, as 5 per cent. of the imports are unaccounted for and may also be used in the fertilizers industry. Two sets of figures are given for tankage and dried blood. They are based on the respective estimates of slaughter in the United States made by the Bureau of Animal Industry and by Mr. F. S. Lodge. The Bureau of Animal Industry derived their estimate of the slaughter partly from the number of animals killed under government inspection, which they regard as 60 per cent. of the whole.

107 - **The Situation of Guano in Peru.** — 1. Annual Report of the Guano Company, « Compañia Administradora del Guano, Limitada », in *Peru To-Day*, Vol. V, No. 4, pp. 858-859. Lima, July 1913. — 2. BILLINGHURST. The President's Financial Message. — *Ibid.* No. 6, pp. 944-968. September 1913 (1).

In the financial message of the President of the Republic of Peru to Congress the following information is found:

According to the contract of January 11, 1890, between the Peruvian Government and the "Peruvian Corporation Limited", the latter was granted, besides other concessions, the following:

a) — The guano existing in Peruvian territory up to the amount of three million English tons, which amount was subsequently reduced to two million tons.

b) — The surplus over 50 per cent. of the guano on the Lobos Islands, which belonged to Peru, after liquidating accounts with Chile.

In accordance with clause 21 of the contract of January 11, 1890, that Corporation has exported from the Peruvian deposits the following quantities of guano:

Years	Tons declared
1891 to 1895	166 877
1896 to 1900	122 739
1901 to 1905	350 169
1906 to 1910	382 151
1911 to 1913 (April)	112 982
	1 134 918

The proceeds from the guano sold by the Peruvian Corporation from 1892 to June 30, 1912, were as follows:

Years	£
1892 to 1896	376 133
1897 to 1901	322 886
1902 to 1906	808 477
1907 to 1911	712 457
1912	141 143
	£ 2 361 096

(1) See No. 112, *B.* Feb. 1913. (*Ed.*).

Peruvian agriculture has only been able to supply itself with guano from the year 1896 to 1912, as follows:

Years	Tons
1896 to 1900	18 384
1901 to 1905	102 216
1906 to 1910	177 212
1911 to 1912	76 048
	373 860

The annual average for the quinquennial period 1906-10 is 35 442 tons, and the average for the last two years has been 38 024 tons.

The supply for the present year will reach 40 000 tons.

The report of the "Compañia Administradora del Guano Limitada" for its fourth year of operation, from April 1, 1912, to March 31, 1913, gives further particulars on the production and home consumption of guano in Peru (See table on page 206).

The greater part of the high grade guano extracted during the past year has been taken from the South Chincha Island, in conformity with the rotation plan now in effect. Other deposits of minor importance have also been worked in accordance with the Government distribution decree of February 25, 1909.

The quantity of guano extracted by the Company for distribution within the Republic for the past four years in comparison with the demand is as follows:

Year	Demand	Production	Percentage of supply
	Spanish tons		
1909–10	38 577	25 370	60
1910–11	58 901	24 921	39
1911–12	73 901	18 656	20
1912–13	105 771	24 350	20

The Directors state their belief that the increased demand is due principally to the desire of the various users of the fertilizer to secure a full order by ordering more than they require. The directors of the Company propose to adopt measures which will result in a rectification of this irregularity.

The proportion of nitrogen in the high-grade guano excavated and the ruling prices for the four years are given as follows:

Year	Percentage of nitrogen	Price per unit	
		s	*d*
1909–10	10.04	3	2
1910–11	10.70	2	5
1911–12	10.14	2	4
1912–13	9.18	3	0

Table showing deposits worked and detailed production of the Guano Company for the past four years (in Spanish tons). *

Deposits	1909-10		1910-11		1911-12		1912-13		Totals	
	Rich	Poor	Rich	Poor	Rich	Poor	Rich	Poor	Rich	Poor
Isla Sur de Chincha	23 512	—	—	—	—	—	20 083	—	43 595	—
Grupo de Asia	1 163	—	135	—	—	—	91	—	1 389	—
Palominos	372	—	—	—	—	—	1 128	—	1 500	—
Fronton	—	850	—	—	—	—	—	—	—	850
Isla Centro de Chincha	—	—	20 811	—	—	—	—	—	20 811	—
Sombrerillos	—	—	648	642	1 320	—	361	—	2 329	642
Viejas (Bahia Independencia)	—	—	—	8 655	—	1 950	—	12 242	—	22 847
Pachacamac	—	—	—	855	—	—	—	—	—	855
Islas Norte de Chincha	—	—	—	—	15 488	18 850	—	—	15 488	18 850
Punta Negra	—	—	—	—	873	—	—	—	873	—
Obillos e Isla Blanca	—	—	—	—	691	—	886	—	1 577	—
Isla Ocoña	—	—	—	—	284	—	171	—	455	—
Santa Rosa	—	—	—	—	—	—	1 354	—	1 354	—
Olleros	—	—	—	—	—	—	276	—	276	—
Other small deposits	323	—	3 327	—	—	—	—	—	3 650	—
	25 370	850	24 921	10 152	18 656	20 800	24 350	12 242	93 297	44 044

* The Spanish ton used in Peru = 2028.66 lbs. English.

Summary.

	Rich	Poor	Total
1909-10	25 370	850	26 220
1910-11	24 921	10 152	35 073
1911-12	18 656	20 800	39 456
1912-13	24 350	12 242	36 592
	93 297	44 044	137 341

The prices of low-grade guano containing less than 3 per cent. of nitrogen for the past two years have been as follows:

Year	£.	s.	d.
1911–12	1	9	3
1912–13	2	0	0

Lastly, in the above-mentioned financial message, the President of the Peruvian Republic states that from the year 1841, when the exportation of guano commenced, to the year 1879, Peru exported over 12 million tons of that fertilizer, with a net profit to the State of about £80 000 000.

The expert ornithologist, Dr. H. O. Forbes, who had been invited by the Guano Company and by the Government to report upon measures to be adopted to prevent the disappearance of the guano-producing birds, presented his report to the Government at the end of April 1913.

108 - **Sulphate of Copper: Production, Trade and Consumption.** — CRIVELLI, E. in *L'Industria Chimica*, Year XIII, No. 24, pp. 369-374 + 1 diagr. Turin, December 25, 1913.

Following on the diffusion of Millardet and Gayon's works (1885) on the influence of copper compounds on vine mildew, all the measures suggested for the control of the parasite were modified and only the active substances (sulphate of copper and lime) were retained. Nevertheless during several years the double sulphates of copper and iron, copper and zinc and also of copper and nickel were still used, and the chemical works, before starting resolutely the manufacture of sulphate of copper on a large scale, hesitated for some time between the production of pure sulphate of copper and the double salts.

The sulphate of copper industry commenced in England between 1885 and 1890. In 1894, that country exported 786 metric tons (1), almost equally divided between Italy and France. The development of production in the whole world is shown by Table I (pp. 208-209).

As for the consumption of sulphate of copper, the data in Table II have for the most part been taken from the *Recueils statistiques sur les métaux*, etc., from the "Metallgesellschaft" and "Metallbank und Metallurgische Aktien gesellschaft" of Frankfort-on-the-Main.

In the consumption of sulphate of copper, Italy occupies the first place. The diagram of the consumption of sulphate of copper in Italy shows decided periods of minima which last always two years. These are years in which the favourable weather limits the consumption of sulphate and the vines yield heavily. Such years are usually followed by one in which the vines are still in good condition and do not require excessive care, whilst the vine growers are not inclined to spend much on account of the low prices of wine due to the heavy crop.

It is also to be remembered that statistics do not consider the probable quantities remaining in the hands of small tradesmen and consumers.

(1) 1 metric ton = 0.9842 English ton.

TABLE I. — *Production of sulphate*

COUNTRY	1894	1895	1896	1897	1898	1899	1900
United Kingdom (1)	36 207	40 091	53 464	60 236	53 112	40 836	43 587
Italy	2 982	3 151	4 756	5 337	6 164	7 795	13 191
United States (2)	—	21 700	22 100	23 600	25 000	30 800	34 900
France (3)	—	—	—	—	—	—	—
Austria (3)	—	—	—	—	8 300	9 200	8 300
Germany	4 809	4 638	6 838	6 400	4 838	5 700	5 300

(1) As it is impossible have precise information on the production of the English works, the
(2) These figures are taken from The *Engineering and Miniug Journal* and include the sulphate
(3) Approximate data from a private enquiry made by the Metallgesellschaft and by the

TABLE II. — *Consumption of sulphate of copper (in metric tons).*

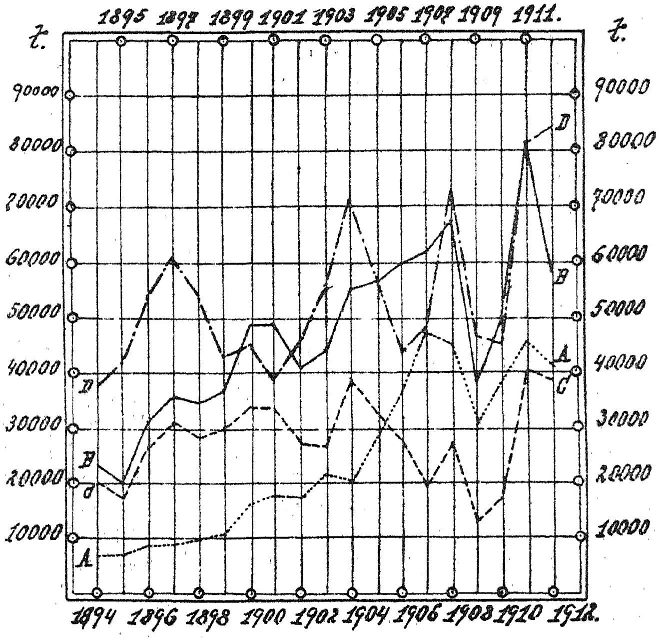
COUNTRY	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
Italy . . .	42 700	54 500	56 600	59 200	60 400	66 900	36 500	49 150	81 400	58 180
France . .	—	—	—	—	21 800	36 800	32 300	31 900	34 900	34 700
Austria . .	11 800	14 400	13 900	12 200	14 970	19 700	14 390	15 160	20 690	31 200
Germany .	5 000	6 100	7 300	5 500	7 800	9 200	11 500	7 100	8 300	12 000

of copper (in metric tons).

1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
36 600	44 000	54 300	71 400	56 800	43 600	46 000	72 400	45 600	43 400	81 100	85 500
15 374	14 601	18 164	17 237	26 212	34 276	45 264	42 598	28 551	36 236	43 626	40 000
35 200	21 800	19 600	28 800	24 000	23 200	20 400	17 200	20 400	12 400	15 200	18 000
—	—	—	—	—	—	15 000	24 000	25 000	26 000	25 000	26 000
8 600	8 200	8 300	10 000	10 200	10 400	11 000	11 400	10 300	11 800	14 100	15 200
5 500	5 200	5 200	6 584	6 988	6 758	5 284	7 117	6 211	5 209	7 500	8 700

figures of the quantities exported are here given.
of copper obtained as a by-product in the metallurgical works which treat copper ores.
Metallbank of Frankfurt-on-the-Main.

Consumption of sulphate of copper in Italy from 1895 to 1911 (in metric tons), compared with exportation from England, etc.



A. Production of sulphate of copper in Italy. — B. Consumption in Italy. — C. Importation into Italy. — D. Exportation from England.

These stocks, which would weigh heavily on the statistics, come into play in producing the apparent diminished consumption observed in the years following an abundant crop. It follows that the increase of consumption rarely increases abruptly after a year of minimum consumption. Independently of any other cause, it is very probable that the ratio between the consumption of 1913 and that of 1914 will be the same as that between other periods of minima, as 1898-99, 1902-03, 1909-10.

109 - **Criticism of the Experiments on the Influence of Atmospheric Electricity on Plants.** — LESAGE, PIERRE in *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 18, pp. 784-787. Paris, November 1913.

The retardation in the growth of plants under metallic cages was supposed to be due to their protection from atmospheric electricity. Experiments were carried out with cress and also with *Datura Tatula*, and to eliminate the effect of the cage structure a batch of plants were grown in a silk cage of exactly similar dimensions to the iron wire cage containing a similar batch of plants. At the end of the three months the plants in the control batch grown in the open air were distinctly larger than the others, but there was no perceptible difference between the plants grown in the different cages. Further experiments on the evaporation of water from a plain surface showed that a cage of small mesh decreased the rate of evaporation by 10 per cent. in still air and by about 30 per cent. in moving air. It would therefore appear that the effect of the cage in diminishing the rate of growth is explained on other grounds than the removal of the influence of atmospheric electricity, even supposing this to exert any influence at all.

110 - **Studies on Differential Mortality in the Germination of Bean Seeds.** — HARRIS, J. A. in *The American Naturalist*, Vol. XLVII, No. 563, pp. 683-700; No. 564, pp. 739-759. New York, November and December 1913.

The mortality of seeds in field cultures of *Phascolus vulgaris* is not random, but selective with respect to seed weight. Both large and small seeds are less capable of developing into fertile plants and are more heavily drawn upon in the mortality than seeds of the modal region of the seed weight distribution. The mortality of the two extremes, however, is so evenly balanced that the mean weight of the survivors does not differ from that of the whole population, while the variability is reduced.

Additional experiments have been made with 46 000 seeds under laboratory conditions to test the above conclusions. These experiments show that in some varieties the heavier, in others the lighter, seeds are most heavily drawn upon in the mortality and that there is a real biological relationship between weight and viability.

The writer has also shown that in general the larger seeds require longer for germination, but the relation of this to selective mortality is still to be worked out.

111 — **On the Assimilation by Plants of Nitrogen in the Form of Tyrosine, Leucine and Witte's Peptone.** — PETROV, G. G. in *Isviestia Moscovskago Selskokhosiaistvennago*, Year XIX, No. 5, pp. 163-183 + fig. 4. Moscow, 1913.

The writer grew maize plants inside large glass cylinders which were hermetically sealed and through which a stream of air containing 1 per cent. of carbon dioxide was continually passed at the rate of 100 litres per day. The plants were supported on a wire netting and their roots dipped into a nutrient solution. The whole apparatus including the solution was sterilized by heating before being used and the seeds were immersed in a 1 per cent. bromine solution — the efficiency of the sterilization being proved by the fact that no micro-organisms were present in the jars at the end of the experiment. The jars were kept in diffused light for from 40 to 64 days.

The nutrient solution in each jar received one of the following nitrogenous compounds: tyrosine, leucine, Witte's peptone, calcium nitrate. At the end of the experiment the plants were carefully weighed and analysed for total and albuminoid nitrogen, for asparagine, and for ammonia.

From the results thus obtained and other existing data relevant to the subject of nitrogen assimilation by plants, the writer draws the following conclusions:

1) Both amino acids (tyrosine and leucine) and Witte's peptone are absorbed by plants and the nitrogen they contain is assimilated; plants are therefore capable of absorbing not only amide but also amine nitrogen.

2) The increase of dry matter and the quantity of nitrogen assimilated by plants fed on the three above substances present two parallel series of figures, in both of which the peptone plants are first in order and the tyrosine plants last.

3) Root development is impeded by solutions of the following concentrations: leucine 0.04 per cent., tyrosine 0.05 per cent., and peptone 0.03 per cent. In these concentrations, while peptone only arrests slightly the development of lateral roots, leucine and more especially tyrosine hardly allow any development of the root at all.

4) Leucine, and to a still greater degree tyrosine, cause a shortening of the roots with an accompanying thickening of the cellular membranes and a consequent abnormal thickening of the roots themselves.

5) As a result of both the present and past experiments with ammonia, asparagine, and calcium nitrate, an inverse ratio is shown to exist between the asparagine and albumen contained by the roots and by the shoots. This confirms the writer's opinion that ammonia absorbed or formed by plants becomes temporarily changed into asparagine, which later forms a nucleus for the elaboration of albumen.

112 — **Individual Variation in the Alkaloid Content of Belladonna Plants.** — SIEVERS, A. in *The Journal of Agricultural Research*, Vol. I, No. 2, pp. 129-146. Washington, November 1913.

Analyses of the alkaloid content of the leaves of individual plants of *Atropa Belladonna* at various stages of growth and in different seasons show:

1) That the leaves can be picked to best advantage from the time of flowering until the early berries begin to ripen. Although the leaves are richer in alkaloids later in the season, they are then too small and sparse for harvesting.

2) That no correlation exists between the general appearance of the plant and the alkaloid content of its leaves, and that luxuriant growth is by no means a criterion of the medicinal value of the plant.

3) That considerable variation exists in the alkaloid content of different plants, thus making it difficult to determine to what extent soil and climate influence the development of alkaloids.

4) That the variation of the alkaloid content of different plants continues in the same direction during different seasons.

113 - **Effects of Illuminating Gas on Vegetation.** - STONE, G. E. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31, Part I, pp. 45-60 + 2 plates. Boston, January 1913.

The injurious effects of illuminating and waste gases on vegetation have been studied in considerable detail by the writer. In the case of the Carolina Poplar (*Populus deltoides* Marsh) the characteristic toxic effects consist of a splitting of the bark and a swelling of the tissues, and later an exudation of slimy mucilage. During the incipient stages the poisonous constituents of the gas appear to have a direct stimulating effect on cell division.

Experiments with willow cuttings grown in water charged with illuminating gas showed that:

1) The development of new shoots and roots began from 4 to 11 days earlier than in ordinary tap water.

2) When the water is charged with the gas more frequently, no further increase of development occurs, but the symptoms of gas poisoning appear earlier.

3) The stimulation of the roots is more vigorous than that of the shoots, the increase in length of the former exceeding 600 per cent., whilst that of the latter is about 200 per cent.

The increased root development is attributed to the attenuation of oxygen in the water, and this theory is supported by the increased development of the lenticels under the action of the gas.

The effect of illuminating gas on dormant willow cuttings was then tried, and it was found that the development of the cuttings was accelerated by treatment in an atmosphere of the gas of from 24 to 72 hours' duration.

114 - **Variations in Osmotic Pressure in Potatoes during Storage.** — BRANNON, M. A. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 433-438 + figs. 1-4. Chicago, November 1913.

In studying the changes taking place in potatoes during storage, observations of the variations in osmotic pressure afford interesting information. Determinations were made in a Beckmann apparatus according to Hamburger's method.

The results showed that:

1) Heat is a factor controlling the processes which give rise to the substances causing variation in the osmotic pressure of potato sap.

2) Low temperatures increase the osmotic pressure and also the acidity, which appears to be the controlling agent in the release of the enzymes hydrolising starch and hemi-cellulose.

3) The carbohydrates hydrolised furnish the energy required by the potato in carrying on its metabolism during cold storage.

Examination of the cell structure of stored potatoes showed that at lower temperatures the cell walls become thinner and more brittle, while with increase of temperature they became tougher.

115 - **The Inheritance of Blossom Colour in Beans *(Phaseolus)*.** — SHAW, T. K. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31. Part I, pp. 182-203 + 1 plate. Boston, January 1913. PLANT BREEDING.

This paper is an account of five years' work on the inheritance of blossom colour in beans (*Phaseolus*). The results so far obtained appear to point to a correlation between blossom colour and seed-coat colour, and it is hoped that more complete analysis of the 1913 results will clear up many difficulties concerning the inheritance of blossom colour.

116 - **Seed Selection of Egyptian Cotton in Arizona.** — KEARNEY, T. H. — *Bulletin of the U. S. Department of Agriculture*, No. 38, 8 pp. Washington, November 19, 1913.

Many varieties of Egyptian cotton have been introduced into Arizona for purposes of acclimatisation and plant breeding. One of these, Mit Afifi, was cultivated and selected for some five or six years, but without improvement. In 1908, however, a superior type appeared amongst the progeny and gave rise to a new variety possessing large bolls and long cream-coloured fibres and quite uniform in its progeny. This variety, known as Yuma, is now grown extensively in the Salt River Valley; it apparently originated as a mutation, and, although it breeds true, it is of great importance to adopt measures to prevent deterioration by cross-fertilization with foreign varieties and by the appearance of inferior mutants. This work can best be done under the guidance of the local Cotton Growers' Associations and the Department of Agriculture.

117 - **The Breeding of Medicinal Plants.** - MILLER, F. A. in *The American Breeders' Magazine*, Vol. IV, No. 4, pp. 193-201 + 2 figs. Washington, D. C., December 1913.

The selection of medicinal plants yielding higher percentages of their specific drugs offers a rich field of development. The chief difficulty encountered in such work is the testing of individuals by long and expensive chemical and physiological assays, but this can be overcome, in part at least, by seeking correlations between high potency and certain morphological characters.

Amongst medicinal plants that have been improved by this process are the following:

Plant.	Yield of alkaloid.						Remarks.
	Normal			After selection			
	Min.	Max.	Average	Min.	Max.	Average	
	%	%	%	%	%	%	
Atropa Belladonna leaves and roots. .	0.23	0.62	0.43	0.55	0.87	0.72	External characters of this plant are extremely uniform, except yield of leaves and roots, the dry matter of which varies from 139 gms. to 203 gms. between different individuals.
Datura Stramonium and *D. Tatula* . .	—	—	0.34	0.46	0.55	—	
			0.35	0.47	0.65	—	
			0.47	0.44	0.57	0.51	
			0.65	0.43	0.77	0.65	

CEREAL AND PULSE CROPS.

118 - **The Classification of Cultivated Rice.** — 1. KIKKAWA, S. in *Journal of the College of Agriculture, Tokyo*, Vol. III, No. 2, pp. 11-108 + plates 5-8. Tokyo, 1912. — 2. GRAHAM, R. J. D. in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VI, No. 7, pp. 209-229 + plates 1-4. Calcutta, December 1913.

1.— The writer has had the opportunity of examining rices from all the more important rice-growing countries in the world and constructs a very complete and detailed classification. He includes a brief summary of the attempts of previous workers in this field, concluding with a more detailed account of Tanaka's classification published in 1900. He follows Tanaka's system in somewhat greater detail and bases his classification on those characters, morphological and otherwise, which are important only from an agricultural point of view.

It is divided into two parts, one based on differences in cultivation and the other on the utility of the grain.

THE CLASSIFICATION OF RICE WITH REGARD TO ITS CULTIVATION.

(*A*) Aquatic rice.
- (*a*) Early. (*b*) Medium. (*c*) Late.
  - (I) Ordinary rice.
    - (α) Tall. (β) Medium tall. (γ) Short.
      - (1) Awned. (2) Awnless.
  - (II) Special rice.
    - (α) Giant. (β) Salt rice.

(*B*) Upland rice.
- (*a*) Early. (*b*) Medium. (*c*) Late.
  - (α) Tall. (β) Medium tall. (γ) Short.
    - (1) Awned. (2) Awnless.

Since the duration of growth of particular rices varies according to the local conditions, any classification including this character must be special for each locality.

Results are given showing the existence of correlation between length of stem and tillering power, and between length of stem and weight of ear.

Giant rices measure above 2 metres in height, and salt rices possess resisting power against injury from sea water.

Other factors considered in this classification are:

1. Colour of glumes and awns.

No correlation exists between the colours of the various parts of the unhulled grain.

2) Colour of the stem and leaf.

3) Long-glumed rice.

These rices have very long empty glumes, sometimes exceeding the flowering glumes.

4) Double rice.

Varieties containing more than one ovary in a spikelet.

5) Form of panicle.

6) Colour of stigma.

CLASSIFICATION OF RICE WITH REGARD TO THE UTILITY OF THE GRAIN.

This classification divides the varieties into two groups, the non-glutinous and the glutinous, each of which is subdivided as follows:

(I) Slender-grained. (II) Long-grained. (III) Short-grained.

(1) Large-grained (2) Medium-grained (3) Small-grained.

(*a*) Common-coloured.

(α) Ordinary. (β) Scented.

(*b*) Specially coloured.

Glutinous rices contain sugar and dextrin and are only used in confectionery. The non-glutinous rices are the ordinary table rices.

Grains are classified according to their dimensions as follows: ratio length: breadth > 3 = slender-grained; < 3 and > 2 = long-grained; < 2 = short-grained; the product of length $\times$ breadth > 18 or 19 = large-grained, < 15 or 16 = small-grained.

Other important characters are:

1) Shape of the hulled and unhulled grains.

This character has some connection with the taste and process of whitening.

2) White-abdomened rice.

This is the name given to those rices possessing a white chalky- looking portion in the middle of the ventral side, that is the side of the grain in which the embryo is situated. Such grains are more easily broken and have a lower specific gravity.

This scheme is adopted in the classification of Burmese rices, which the writer gives in an appendix of 76 pages.

2. — This is a preliminary note on the progress of the work of the last five years on the classification of the rices of the Central Provinces, India. It includes an introductory account of the acreage under rice and the character of the soils in this area.

The classification adopted follows somewhat the lines of that of Kikkawa, but gives more attention to characters of no direct agricultural value, such as the colour of the ligules and sickles (auricles), the length of the peduncle, the type of inflorescence (whether erect, curved or drooping), the arrangement of the spikelets, the shape of the rachilla, and the characters of the apiculus and awn.

The writer gives a classification of a number of non-glutinous rices of the Central Provinces, based chiefly on their vegetative characters and to a less extent on the dimensions of the grain and spikelet.

119 — **The Gases of Swamp Soils; their Composition and Relationship to the Growth of the Crop.** — HARRISON, W. H. and SUBRAMANIA AIYER, P. A. in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. III, No. 3, pp. 65-106, plates 1-4 + figs. 1-6. Calcutta, October 1913.

Considering the apparent inconsistencies in the customs of the natives with regard to the time and manner of applying green manures to their paddy fields, it seemed desirable to make a detailed study of the conditions of growth in such soils before any guidance or improvements could be suggested. With this object in view, a study of the soil gases was undertaken as being the most promising field of enquiry.

Disturbance of the soil puddle in paddy fields liberates the soil gases, which bubble through the irrigation water. Analysis of these gases showed that they consist chiefly of methane and nitrogen in widely varying proportions, with small and variable amounts of carbon dioxide, oxygen and hydrogen. A study of this variation showed that before planting out the proportion of methane is high and that of nitrogen low, while after planting the seedlings, the proportions of the gases are reversed, the hydrogen being in excess. This continues until the ripening of the crop, after which stage the proportions of methane and nitrogen approach those of an uncropped soil.

Analysis of the soil gases immediately after flooding the fields shows that the anaerobic condition commences within a few days, and long before planting out.

These experiments lead to the conclusion that the plant absorbs its supplies of nitrogen in the form of ammonia and nitrogenous organic compounds, and that the crop restricts the formation of methane and hydrogen, either by retarding the rate of fermentation or by the absorption by the roots of a portion of the intermediate products of decomposition.

Analysis of the surface gases showed that they consist of oxygen and nitrogen; carbon dioxide, methane and hydrogen were absent. Studies on the variation in composition of these gases showed that during the period of active growth of the crops the percentage of oxygen was reduced, and that the application of organic manure increased the production of oxygen, while destruction of the algal slime by means of copper sulphate solution

considerably decreased it. Decreased production of oxygen was also associated with a decreased production of nitrogen.

These experiments lead to the conclusion that the roots of the rice plant absorb oxygen and that most of this oxygen is produced by the algal slime in the water, excess of oxygen being evolved in the form of bubbles into which the nitrogen dissolved in the water diffuses according to Dalton's Law. The increased activity of the slime organisms, due to the decomposition products of the organic matter in the soil, results in an increased output of oxygen and a consequent greater root activity of the crop.

Artificial drainage and aeration of the soil increases the root development within narrow limits, beyond which destruction of the algal slime takes place and nitrification probably begins. The beneficial effects of limited drainage appear to be due to the removal of toxic decomposition products and aeration of the roots. The writers are therefore led to conclude that the drainage of paddy soils requires very careful consideration and except in toxic soils is better replaced by a natural system of root aeration effected by green manuring and the development of the algal slime.

120 - **The Sweet Potato as a Cover Crop in Coconut Plantations.** — SCHAEFFER, G. Entretien économique d'une jeune cocoterie. — *L'Agronomie Coloniale*, Year I, No. 5 pp. 136-137 + 2 plates. Paris, November 1913. ROOT CROPS.

During a visit to the Malay States in 1913, the writer saw young coconut plantations in which sweet potatoes (1) were grown as a cover crop on black peaty soils with excellent results.

The advantages of this crop are: 1) its rapid growth and spreading habit, giving complete protection to the soil; 2) reduction in expenses of cultivation; 3) natural decay of the plant when the trees reach maturity.

121 - **Cotton Cultivation and the Cotton Industry throughout the World.** - WOEIKOF, A. in *Annales de Géographie*, Year XXII, No. 126, pp. 385-398. Paris, November 15, 1913. FIBRE CROPS.

The average yield of cotton from each country during 1907-10 is given in the followibg table:

	Millions of tons.	Percentage of total.	Yield per acre.
United States	2 454	62.2	180 lbs.
India	695	17.7	72 lbs.
Egypt	292	7.4	410 lbs.
Russian Empire	172	4.3	—
China	132	3.4	—
Brazil	76	1.9	—
Peru	22	3.1	—
Mexico	26		—
Turkey	16		—
Persia	15		—
Other Countries	42		—
Total	3 942		

(1) The sweet potato (*Ipomoea campanulata*) or « Ubi », is a favourite vegetable of the various Asiatic races of the Malay Peninsula. (Ed.)

The value of the world's total production of cotton is about 250 millions sterling. The most important producing country is N. America, but further development is hindered by unsuitable climatic conditions in the west and south and the scarcity and dearness of labour, the latter being an almost insuperable difficulty. Further development in Egypt is also improbable except in the higher regions, which will only produce inferior varieties of cotton.

Besides, these countries have reached their highest yield per acre. In 1901-02 the yield per acre in Egypt was 460 lbs. per acre, while in the years 1908-10 it had fallen to 370 lbs.

The ideal conditions required for successful cotton cultivation are: *a*) a soil with abundant moisture; *b*) a low rainfall; *c*) abundant sunshine; *d*) a humid atmosphere, and *e*) an abundant supply of labour. These conditions are to be found in Asia, particularly in India, Turkestan and Mesopotamia, and it is in these countries that future developments in the cultivation of cotton will take place. Some parts of Nigeria abundantly supplied by the Niger also offer great possibilities of development in this direction, almost equal to those of Mesopotamia.

122 - **Studies of the Primary Market Conditions of Cotton in Oklahoma.** — SHERMAN, W. A.; TAYLOR, FRED; and BRAND, C. J. — *Bulletin of the U. S. Department of Agriculture*, No. 36, pp. 1-36. Washington, D. C., November 15, 1913.

The system of handling and marketing cotton in vogue today has become extremely complicated owing to the needs and demands of the middlemen, who at best have only a temporary interest in the product, while the claims of the grower and the requirements of the consumer are mostly ignored. This investigation was undertaken in Oklahoma to abtain exact information of the state of things and the various factors controlling the market price of cotton. The questions investigated on behalf of the grower comprise the following:

1) The proper grading of the cotton.
2) The premium obtained for the higher grades.
3) Unjust reduction for low grades.
4) Variations in market price from town to town.
5) Variations in local markets.
6) Relation of farmer's selling price to spinner's buying price.

The investigations were carried out in 103 towns; over 3 200 bales of cotton were sampled and graded, and records were made of the date, place of sale and price paid to the grower. No evidence was obtained that any attention is paid to the variety of short-staple cotton when fixing the price, and the only characters of an improved variety that are of any value to the grower are its yield and its percentage of lint.

The results of the investigation are summarised as follows:

1) The ginners pay nearly the same for all cotton pu[illegible] given day, whether buying in seed or in the bale.

2) In street markets where there are large numbers of buyers [illegible] differing prices are paid on the same day for bales of identical quality [illegible]

3) The premiums on grades above middling are only one-half those quoted on the New York Stock Exchange, and the premiums actually paid in open street buying are considerably less than those advertised for such grades.

4) Accurate knowledge of cotton grading is of little value to the producer under present conditions, and the grading of the larger firms is often forced upon independent ginners and local merchants when their cotton is " taken up ".

5) Length of staple appears to be no criterion in fixing the price of the individual bale in most districts, but certain farms receive slightly higher prices than others because of reputed superiority of average staple. The prices paid to farmers are too largely based on a system of averages, which discourages the improvement and adoption of better varieties.

6) The present evils may be remedied to some extent by the adoption of a properly organised system of cooperation among growers for the purpose of grading before marketing, but present conditions would probably necessitate a rather expensive selling department.

123 - **Report on the Flax Experiments at Dooriah (Bengal) during 1912-13.** — VANDEKERKHOVE, E. M. in *Agricultural Research Institute, Pusa, Bulletin* No. 35, pp. 1-15. Calcutta, 1913.

This bulletin contains the results of field experiments with flax, and tables showing the working and manufacturing outlay and the approximate balance.

The following results were obtained:

Average Yield.

	in maunds per bigha	per acre
Rippled straw	288.05	82.25 cwt.
Seed	261.75	75.0 »
Flax fibre	3.5	98 lbs.
Tow	3.12	87.36 »

The total expenditure at Dooriah, including interest on capital (8 per cent.) and freight and shipping charges, amounted to Rs. 7 693, and the returns from seed and fibre harvested amounted to Rs. 14 396, leaving a balance of Rs. 6 703 from 83 bighas, or Rs. 91 per acre. The corresponding profit in 1911 was Rs. 89 per acre, thus making an average of Rs. 90 or £ 6 per acre for the two years.

On the central factory system the profit from the planters' point of view works out at Rs. 29 per acre and from the *assamis'* point of view, *i.e.* not charging the cost of labour, Rs. 40 per acre.

The profits from a central factory, including interest on capital, insurance and depreciation, work out at 7.3 per cent. on the capital outlay, which for a factory sufficient for 600 bighas (523 acres) is estimated at 87 300 Rs., or about £5 820.

Details are also given of the cost of labour and the various operations under local conditions.

The seed should always be imported fresh, as it loses its superiority after three years' acclimatization. A three-course or four-course rotation with rice, Rabi crops or indigo gives very good results. Manuring with superphosphate appears to improve the yield of fibre and tow.

124 – **The Present System of Grading Abaca (Manila Hemp); its Defects and Remedy.** — SALEEBY, M. M. in *The Philippine Agricultural Review*, Vol. VI, No. 10, pp. 504-512 + 4 plates. Manila, P. I., October 1913.

Any system of grading in order to be complete and in accordance with the requirements of the consuming market must include the consideration of the colour, strength, length and texture of the fibre. Colour and strength are the most important qualities considered in the lower grades, while the length is ignored unless decidedly below 1 ⅓ meters.

The colour is dependent upon the method and degree of cleaning and drying and on the position of the sheath in the stalk. The strength of the fibre is also dependent upon these factors, as well as on the variety of the plant, while the texture is chiefly dependent on the variety of the plant and the soil and climatic conditions. The sheaths of every stalk vary in colour and size, thus causing corresponding changes in the fibre; but the number of grades adopted in commerce is far in excess of these natural variations of the plant and of those due to the methods of preparation. This difference in the interpretation of the same grade between two different establishments is often as great as that between two consecutive grades or marks of the same firm.

To protect the industry from this confusion, the writer recommends the adoption of a Government system of grading.

SUGAR CROPS.

125 – **The Experimental Error in Sampling Sugar-Cane.** — LEATHER, J. W. in *Memoirs of the Department of Agriculture in India*, Vol. III, No. IV, pp. 107-133. Calcutta, October 1913.

Determinations of the sucrose content of individual canes showed that the probable error of the mean of 120 determinations was ± 0.17 per cent. It follows therefore that the error of the determination of a sample of 120 canes will not exceed ± 0.5 per cent. in more than 1 case in 20.

Since the accuracy of a sugar-cane determination does not exceed 0.5 per cent., the determination of a sample of 120 canes will give reliable results.

Selections of canes from different parts of the same plots not exceeding 1 acre in area were made, and it was found that the probable error in such cases was no greater than that of a selection of canes from one definite position, showing that the variation due to soil over an area up to 1 acre was negligibly small compared with that due to individuality amongst the canes.

126 - **Yield and Returns from Palm Oil Trees in French Guinea.** — NICOLAS, L. in *L'Agronomie Coloniale*, Year I, No. 5, pp. 138-143. Paris, November 1913. OIL CROPS

Experiments on the preparation of palm oil from *Elaeis Guineensis* by the native method during 1911-12 have given the following results:

Total yearly production from 590 trees:

Fruits.		
No of bunches of fruit	2 521	
Total weight	44 300	lbs.
Total weight of fruit	25 570	»
Average weight of fruit per bunch	10.1	»
Oil.		
Total weight of oil extracted by native method	2 073	»
Average weight of oil per bunch	0.82	lb.
Percentage of oil extracted from fruit	8.1	
Palm nuts.		
Total weight of palm nuts obtained	16 208	lbs.
Average weight of palm nuts per bunch	6.43	»
Percentage of palm nuts in the fruits	63.4	
Kernels.		
Total weight of shelled kernels	4 528	lbs.
Average weight of kernels per bunch	1.80	»
Percentage of kernels in the fruit	17.7	
Percentage of kernels in the palm nuts	27.9	

Analysis of the results obtained from the harvests at different times of the year shows considerable variation in the yield of oil and nuts. In May the yield of fruit is much less than in October and January, but the percentage of fruit per bunch and the percentage of oil obtained from the fruits is much higher, whilst the percerntage of nuts in the fruits is much lower.

Annual returns from a plantation of 590 trees:

	£	s
2073 lbs. of oil at nearly 3 *d* per lb. (at Conakry)	24	5
4528 lbs. of kernels and 2200 lbs. of kernels gathered from the ground beneath the trees, making a total of 6728 lbs. of kernels at about 1 ½ *d* per lb. (at Conakry)	42	8
Total income from 590 trees . . . £	66	13

Corresponding to a return of 2 *s* 3 *d* per palm tree in bearing.

127 - **Tapping Ceara *(Manihot Glaziovii).*** — DE WILDEMAN, E. A propos du Manihot. — *Le Caoutchouc et la Gutta Percha*, Year 10, No. 117, pp. 7773-7774. Paris November 15, 1913: after ARENS, P. in *Mededeelingen van het Proefstation Malang*, No. 6. Malang, 1913. RUBBER, GUM AND RESIN PLANTS.

Manihot seems to be advisable where Hevea does not thrive; consequently Dr. Arens has attempted to determine the best method of tapping it. He considers that the half fish-bone as practised on Heveas gives the best results, at least in Java. The yield of the *daily* tappings is 15 grams

for four-year-old trees, a workman being able to tap 200 trees per day. This method appears to allow the quickest healing of the scar.

The writer attaches much importance to the planing down of the bark where the incision is to be made. He warns against long cuts. The knife to be used is a modification of Burgess'.

128 – **An Improvement in the Method of Preparing Brazilian Rubber.** — CAYLA, M. V. in *Journal d'Agriculture Tropicale*, Year 13, No. 149, pp. 329-333. Paris, November 1913.

F. Ripeau has invented a metallic cylinder to replace the stick of the "seringueiro" in the preparation of Brazilian rubber. It consists of an aluminium cylinder rotating about its horizontal axis. The latex is sprayed onto the cylinder and exposed to the action of smoke. The rubber is removed from the cylinder in sheets of about 3 to 5 mm. ($^1/_8$ to $^1/_5$ in.) thick.

The advantages claimed for this method are:

1). Rubber of Fine Hard Pará quality is obtained without its impurities.

2). The purity of the rubber effects a saving in transport.

3). The cylinder, light in weight, is worked by hand and easier to manipulate than the large rollers formerly used.

4). Reduction in labour; 12 litres (2 ½ gallons) of latex can be coagulated in 1 hour by this method as against 1 $^3/_4$ hours by the native method.

129 – **The Standardisation of Plantation Rubber.** – Report of the Rubber Growers' Association, in *India Rubber Journal*, Vol. XLVI, No. 24, pp. 19-24, London, December 13, 1913.

To remedy the unsatisfactory condition of prices for plantation rubber, the Rubber Growers' Association recommends the establishing of a central testing station and the adoption of an approved scheme of standardisation as a basis for determining the market prices of the different grades.

The proposed tests are to comprise: 1) determination of vulcanizing capacity (rate of cure); 2) tests on the vulcanized product, determining tensile properties, physical condition and stability. A high quality of plantation rubber is to be taken as standard quality with an index figure of 1000, inferior grades to be indexed in relation to this standard.

By the adoption of this system of indicating the quality of the rubber to the seller (*i. e.* the producer) and the value to the buyer, the Association hopes for a material appreciation of prices all round compared with prices for finest grades of wild rubber.

VARIOUS CROPS.

130 – **Manuring Tobacco by Spraying the Leaves with Solutions of Potash Salts: Experiments in Hungary.** — COLOMAN, KERPELY in *Köztelek*, Year 23, No. 99, pp. 3330-3331. Budapest, December 24, 1913.

Professor L. HILTNER, Director of the Agricultural Botany Institute of Munich, has drawn the attention of agriculturists to a new manner of using potash salts. He demonstrated in 1911 that potash salts (sulphate and chloride) in suitably diluted solutions, if sprayed onto growing plants, penetrated into them and were absorbed (1). The effects of repeated

(1) HILTNER, L. Ueber eine neue Verwendungsmöglichkeit für Kalisalze und andere düngender Stoffe. — *Mitteilungen der Deutschen Landwirtschafts Gesellschaft*, 1911, 26, Stück 19, 231.

spraying were in so far favourable that the plants submitted to the treatment developed more vigorously and gave a higher yield than those not treated. HILTNER'S experiments were mostly made on white mustard, soya beans and potatoes.

In Hungary the Royal Tobacco Experiment Station at Debreczen conducted a series of experiments with the object of ascertaining whether this method could be applied to the cultivation of tobacco. The experiments made in 1911 gave negative results on account of the unfavourable weather; they were repeated in 1912, using the large-leaved Szegedi Rózsa variety and the small-leaved selected garden Réthát tobacco, on plots 662 sq. yards in extent. Three weeks after the striking of the plants that had been transplanted (June 11) spraying was commenced, a 2 per cent. solution of sulphate of potash being applied by a common knapsack sprayer. The operation was repeated every seven days up to July 24.

At the same time comparative experiments were made between morning spraying after the dew had evaporated and evening spraying before nightfall. In 1912 the weather was favourable to tobacco, as the rains did not begin in Hungary before the middle of August when the plants were already ripening and consequently did not cause any trouble, except during the harvesting and drying. Whilst spraying, care was taken to wet the whole surface of the leaves. With the growth of the plants the treatment involved more labour and proportionately a greater quantity of solution.

With the variety Szegedi Rózsa, planted at distances of 20 × 28 inches (11 200 to the acre), the work was quicker and less expensive than with the Réthát variety planted closer (12 × 20 inches or 27 624 to the acre), as may be seen in Table I.

TABLE I.

Time and quantity of liquid employed in spraying plots of 662 square yards.

Date of spraying	Szegedi Rózsa			Réthát		
	Labour		Liquid used — gallons	Labour		Liquid used — gallons
	hours	minutes		hours	minutes	
June 11	2	—	21.12	5	20	40.48
» 18	2	50	35.20	8	—	59.84
» 25	3	20	42.24	8	40	73.04
July 2	4	40	56.32	12	40	114.40
» 9	5	20	75.68	16	—	132.00
» 16	10	—	119.68	16	—	142.56
» 23	12	—	132.00	17	—	158.40
Total of sprayings	40	10	482.24	83	40	720.72

The expense per acre based on the above data works out as follows :

	Tobacco					
	Szegedi Rózsa			Réthát		
	£	*s*	*d*	£	*s*	*d*
Labour	2	12	7	5	12	4
Sulphate of potash	3	17	4	5	14	10
Drawing water, preparation of solution, carriage, etc.	1	19	2	2	16	2
Total	£8	9	1	£14	3	4

This shows the expense per acre to be considerable for both varieties and distances of planting.

The effect of spraying appears in the more vigorous development of the plant, the greater length of the stems, the more numerous leaves and their fresher colour. This difference was more specially noticed on the plants treated in the morning, while in those sprayed in the evening it was less conspicuous. This fact confirmed the opinion of the writer that the absorption of potash by the leaves was more active in the morning, when the process of absorption begins, than in the evening, which opinion is corroborated by the data on the yields, given in Table II.

TABLE II.

	Plots of 662 sq. yds.	Per acre	Increase of yield per acre	Average number of leaves per stem	Combustibility of the leaves
	lbs.	lbs.	lbs.		seconds
Szegedi Rózsa variety.					
Without spraying	226.2	1593.70	—	12.2	20
Morning spraying	339.2	2390.07	796.37	17.5	48
Evening spraying	277.6	1856.47	362.77	14.7	42
Réthát variety.					
Without spraying	287.5	2026.22	—	15.5	13
Morning spraying	426.8	3007.56	981.34	18.1	22
Evening spraying	367.4	2588.98	562.76	16.6	21

It appears from the above that spraying 2 per cent. sulphate of potash solution improved the combustibility of the leaves and increased the yield, especially when the spraying was done in the morning.

Table III shows the financial results of the treatments.

TABLE III.

Variety of tobacco	Cost of spraying per acre	Value of greater yield	Deficit per acre
	£ s d	£ s d	£ s d
Szegedi Rózsa	8 9 1	morning 6 15 5	1 13 8
		evening 3 1 7	5 7 6
Réthát	14 3 4	morning 11 2 4	3 1 0
		evening 6 7 5	7 16 0

The final result of the experiments is a loss, in spite of the considerable increase obtained in consequence of the morning spraying and the very favourable weather of 1912.

The writer concludes that the favourable effect of spraying with potash solution under favourable climatic conditions is undeniable, but that the necessary expense is so great that this method will be of no practical importance for tobacco growers.

131 – **Experiments in Bulb Growing in the United States.** – DORSETT, P. H. — *Bulletin of the U. S. Department of Agriculture*, No. 28, pp. 1-21 + figs. 21. Washington D. C., November 1913. MARKET GARDENING

Bulb growing has been attempted in various parts of the United States, but with very doubtful success until recently, when the Department of Agriculture opened an experimental bulb garden on a selected plot of ground at Bellingham, Wash. At this station bulbs for forcing have been grown superior to the best imported Dutch bulbs; but when these are grown in other parts of the United States, the same deterioration sets in in subsequent years as with imported bulbs. Experiments are also being conducted with machinery with a view to reducing the cost of production.

It appears that the success of bulb growing in the United States depends chiefly on the suitability of soil and climate.

132 – **Present State of Fruit Growing in Greece.** — *Communication from* J. BRICHET, *Fruit Specialist to the Royal Ministry of Agriculture, Agricultural Station of Patras.* FRUIT GROWING.

With the development of Greece, both economic and social, there has been a steady development in fruit growing. This growth has been brought about by private enterprise and by the assistance of arbor societies, sometimes supported by the authorities; and although the plantations are not so extensive as in some other parts of Europe, their utility has none the less been realised.

The size and nature of the fruit plantations, now fairly abundant, varies according to the district and the suitability of the particular species for the spot. The Greek is not a systematic cultivator and if he sometimes

reaps great profit from his trees, he owes it entirely to the nature and climate of certain favourable neighbourhoods. Cultural methods other than simple tillage and manuring are neglected. Notwithstanding this fact handsome crops are often obtained. On the slopes of Pelion crops of half a ton of juicy apples are gathered from a single tree, while in the district of Patras and in the Valley of Leonidion in Arcadia pear trees as big as planes may produce each 6 or 8 cwt. of pears. In the Eparchy of Lepanto and in the Peloponnesus, on the slopes of Mt. Chelmos, huge walnuts are found yielding prodigious quantities of fine nuts.

From the fruit growers' standpoint Greece may be divided into two zones: one, the maritime and littoral zone, has a fairly temperate climate and comprises the islands, the slopes of the mountains facing the sea, sometimes cut into by deep and very fertile valleys, and the generally low and often extensive plains between the mountains and the sea; the other, the inland zone, is mountainous and consists of plateaus and narrow valleys at a height of 400 to 1000 m. (1300 to 3300 ft.), with great extremes of climate.

In the most favourably exposed parts of the former zone are found all the citrus fruits (including citrons), as well as almonds, pistachios, Japanese medlars, peaches, carobs, figs, pomegranates and pears on quince stock. In the latter zone, pears on pear stock, apples, walnuts, cherries, apricots, plums, peaches on plum stock, and agriots are cultivated with success.

Owing to the lack of systematic cultivation and technical knowledge, pomology is still in an elementary condition. Most of the varieties, except those recently introduced from other parts of Europe by the Ministry of Agriculture and a few private individuals, are modifications of native varieties produced by changes in climate and stocks upon which they are grafted. They are so numerous and are given such different names in different localities that it is very difficult to classify them. They include some exquisite fruits with heavy cropping powers when systematically cultivated, whose preservation, when local consumption or exportation is not adequate for their utilisation in a fresh state, should prove a profitable industry.

At present fruits are chiefly grown to supply local needs, as in the absence of technical knowledge concerning the production of high-class fruit and its preservation and packing, the export trade is not as important as it should be. The exportation is so far almost confined to citrons from the Islands and the Gulf of Corinth (sent to America), lemons from Paros and Messenia (for England and Russia), and apples from Pelion (for Egypt and the Asiatic coast). Generally most of the fruit is consumed in Greece, Athens taking the bulk and the choicest. Patras, Volo, Chalcis, Lamia, Aighion, Calamata and Nauplia are the chief centres for the producing districts. The price of fruit often reaches exorbitant figures in the market of the capital.

Since the foundation of the Ministry of Agriculture nearly three years ago, there has been a sustained effort towards utilising the natural resources of the Country by developing fruit trees, which form the crop most suited to the somewhat capricious climate. The appointing of French

fruit specialists, the creation of large nurseries to provide growers with suitable trees at reduced rates, the introduction of varieties of greater value, the creation of posts of itinerary instructors to supply the cultivator with advice and information, have all contributed to the rapid development of fruit growing.

Fruits grown in Greece are superior to the same varieties grown in other parts of Europe in taste and colour. Among pears, the varieties Duchesse d'Angoulême, Epargne, Beurré Diel, Beurré Napoléon and Williams' Bon Chrétien have been cultivated in Greece for some years and give abundant yields of succulent fruit with good keeping qualities. Further there exist scattered here and there throughout the country a few imported varieties long since acclimatized and known by the names Bersimi, Canellini, Spinocarpi, Campana and Tsakonika, all yielding excellent fruits with good keeping qualities; great quantities are produced in the districts of Patras and Leonidion in Arcadia. The summer variety Doyenné de Juillet, known in the country as Doukessa, gives an abundance of excellent fruit. We may also mention a variety of summer pear very widely distributed in the Peloponnesus known as Kontopodaroussa, not of very good quality but ripening early in July, which gives rise to a very important local trade.

The varieties of apples are still less known. Besides the excellent and heavy-cropping variety known as Firiki on Pelion, there are only a few varieties introduced by amateurs and grown in a few gardens. From specimens of Reinette grise du Canada, Calville blanc d'hiver and Rambour d'été met with, the writer is convinced that they can be cultivated with success in the interior mountainous region.

Peaches yield first class fruits and their cultivation properly undertaken could give rise to a successful industry in early fruit. Unfortunately the very early varieties for export are not yet adopted.

The walnuts from the Lepanto district are renowned for the abundance and quality of their nuts.

Cherries, agriots, plums and apricots from all the eastern parts of Greece and the island of Euboea might give rise under rational cultivation to a dried or preserved fruit industry.

Olives, dessert grapes and figs are superior to those of any other country on the Mediterranean.

With the exception of the vine, these fruits are rarely made the objects of systematic cultivation. The cultivator generally lacks the rudiments of knowledge of how to treat the trees, and continues blindly in old-fashioned errors and prejudices. This difficulty of finding experienced men is a great drawback to amateurs who would wish to spend their time and capital on fruit growing.

The Ministry of Agriculture, with a view to developing fruit growing as a source of national wealth, is about to set up model establishments at Patras and various other centres to carry out: 1) experiments in fruit cultivation, 2) production of trees for distribution on a large scale, 3) experiments with different stocks and varieties and their acclimatization and uses, and 4) the training of skilled men for fruit tree work.

133 – The Pollination of Fruit Trees in relation to Productiveness and Planting. HOOPER, C. H. in *The Gardener's Chronicle*, Vol. LIV, No. 1406, pp. 393-394; No. 1407, p. 420. London, December 1913.

The writer gives the results of observations conducted at Wye, Kent, over a period of six years on the blossoming of apples, pears, plums and cherries, with the object of determining:

1) The degree of self-sterility or self-fertility.
2) The relative order of flowering of the different varieties.
3) The most productive pollenisers.

Experiments on the conveyance of pollen by wind in the orchard showed that the quantity is insufficient to pollinate even adjacent trees and that insects appear to be the chief transport agents. Further experiments showed that insect visitors of fruit consist of 73 per cent. hive bees, 21 per cent. bumble and other wild bees and 6 per cent. other insects.

134 – *Citrus ichangensis*, a Promising New Hardy Species of Citrus from S. W. China and Assam. — SWINGLE, W. T. in *The Journal of Agricultural Research*, Vol. 1, No. 1, pp. 1-14, + figs. 1-7 and 1 plate. Washington, October 10, 1913.

The Ichang lemon (*Citrus ichangensis*) was first collected in south-west China in 1888 by Henry; it was found again in 1903 by Wilson. Its occurrence in a wild state farther north and at higher altitudes than any other evergreen citrus suggests great possibilities in breeding cold-resistant citrus fruits. The size of its seeds makes it probable that it will produce very vigorous seedlings suitable for stocks for other citrus fruits, while the popularity of its fruit and the high prices it commands at Hankow, suggest that it will be a valuable addition to our list of citrus fruits.

It is distinguished from other members of the genus by its huge, thick seeds, its long, slender leaves, with their very large broadly-winged petioles, often exceeding the blade in area. The writer gives a botanical description of the plant, illustrated by diagrams and plates, and its distribution in China.

135 — The Pubescent-Fruited Species of *Prunus* of the South-Western States. — MASON, S. C. in *The Journal of Agricultural Research*, Vol. I, No. 2, pp. 147-177 + figs. 8 + plates 8. — Washington, November 1913.

The writer describes seven species of *Prunus* indigenous to the south-western States, which show closer affinities with some of the Asiatic species than with the wild plums of the country. Their adaptation to fluctuations of heat and cold, severe drought and considerable alkalinity of the soil suggests possibilities to the fruit grower of adaptable stocks for such regions and wider scope for the plant breeder.

Contrary to former belief, these species can be divided into small groups of quite diverse character and affinities.

Genus *Prunus.*

Subgenus *Empleciogradus.*

Four species: *Prunus fasciculata* Gray, *P. minutiflora* Engelm., *P. microphylla* Hems., and *P. Havardii* (Wight), n. comb.

Subgenus *Euprunus.*

Section *Piloprunus* n. sect.

One species: *Prunus texana* Dietr.

Section *Penarmeniaca* n. sect.

Two species: *Prunus Andersonii* Gray and *P. eriogyna* n. sp.

136 - **A New Graft-Hybrid.** — DANIEL, L. in *Comptes-Rendus de l'Académie des Sciences*, Vol. 157, No. 21, pp. 995-997. Paris, November 24, 1913.

The roots of an old pear tree (on quince) gave rise to a sucker in 1912 which developed into an individual exhibiting characters, some of which were intermediate between the two parents while others reproduced those of one parent only but in an intensified degree. The case is the more remarkable as the graft-hybrid did not arise at the point of union of the stock and scion and that another sucker situated nearer to the point of union developed into a pure quince.

137 - **An Economic Study of Acacias.** — SHINN, C. H. in *U. S. Department of Agriculture, Division of Publications, Bulletin* No. 9, pp. 1-38 + 11 plates. Washington, December 5, 1913. FORESTRY.

The writer gives a detailed account of the various species of *Acacia* growing in America, pointing out their suitability for timber, commercial exploitation of bark, tannin and gums, as shade trees, for reclaiming and fixing waste sand, and for fodder. He also gives notes on their propagation, growth and management.

LIVE STOCK AND BREEDING.

138 - **Rinderpest: Further Investigations on Questions Connected with the Economical Production of Antiserum.** — HOLMES, J. D. E. (Imperial Bacteriologist, Muktesar) in *Memoirs of the Department of Agriculture in India, Veterinary Series*, Vol. II, No. 2, pp. 33-80. Calcutta, November 1913. HYGIENE

The production of rinderpest antiserum was previously attended with considerable cost, as the virulent blood used for immunising and hyperimmunising the subjects preparatory to drawing off the antiserum, was obtained from an animal at the height of the malady, to which it usually succumbed.

The substitution of buffaloes for hill bulls as virus producers effected a great economy, as the former will survive an attack of rinderpest and not only produce virulent blood while suffering from the malady, but also antiserum when recovered. The writer experimented with hill bulls, which were inoculated with virus and received at the same time a protective dose of

serum, thus contracting the disease in a very mild form. The virulent blood from these animals was then used for hyperimmunising hill cattle, with the result that the serum subsequently produced proved almost as potent as when virus was used which had been taken from hill cattle at the height of an unattenuated attack.

In a second set of experiments the writer contrasted the potency of serum obtained after a natural recovery or an immunising reaction alone, with the potency of serum from hyperimmunised cattle, and found that the two were very nearly equal. He also tested the potency of the 1st, 2nd and 3rd bleedings after hyperimmunisation, and showed that the potency of the serum from hill bulls and buffaloes did not remain up to standard after the 3rd bleeding, while that from the plains cattle fell below after the 2nd bleeding, so that the practice of drawing blood 6 to 12 times from a hyperimmunised animal should be discontinued. Finally, a set of experiments was carried out to determine the minimum dose of virus required to hyperimmunise the bulls; it was found that the usual dose of 10-12 cc. per lb. of body-weight could be reduced to 2.5 cc. per lb. of body-weight for plains cattle and to 3 cc. per lb. of body-weight for hill cattle or buffaloes without decreasing the potency of the serum obtained subsequently, and further that animals will continue to produce serum of the same value if re-infected, even though the volume of virus injected each time remain the same.

ANATOMY AND PHYSIOLOGY

139 – **Experimental Rachitis in Young Animals, the Offspring of Parents Deprived of the Thyroid Gland.** — CLAUDE, H. and ROUILLARD, J. in *Comptes Rendus Hebdomadaires des Séances de la Société de Biologie*, Vol. 75, No. 37, pp. 640-643. Paris, December 26, 1913.

The writers removed the thyroid gland from a male and a female rabbit shortly before pairing them, in order to test the effect of thyroidectomy on the growth of the bones in the offspring. The female dropped eight normally developed rabbits and suckled them for forty days. During the first three weeks the young rabbits grew normally, then four of them died, but their skeletons did not show any apparent deformity. The remaining animals developed well up to the age of about six weeks, when they ceased to grow, their weight remaining stationary; they appeared depressed and sleepy, showing weakness in the limbs and at last impaired digestion, and three of them died between the ages of 7 and 13 weeks. Their skins, like those of the first four that died, did not present any pathological appearance. Their live weight was between one-half and one-third that of the control animals. The fourth rabbit survived and its subsequent development was normal.

The post mortem examination of the three animals revealed important lesions of the skeleton: all three presented very marked deformities of the thorax, the front of which was flattened; the breast-bone was curved and the backbone also. At the articulations of the ribs there were spindle-shaped or irregular nodosities, and the radial, cubital and tibial epiphyses showed increase of volume with very marked lengthening of the connecting cartilage, increase of the chondroid stratum and excessive vascularisation. The short and flat bones contained very much marrow. In all of

the animals the pelvis was much narrowed and in one of them the incisives presented curvatures.

On examining sections of the chondro-costal articulations under the microscope, alterations quite comparable to those occurring in human rachitis were observed and are described by the writer in his paper.

A second litter from the same parents seemed normal at first, but then showed insufficient development and died young, but the lesions of the skeleton were not so characteristic of rachitis.

The writers draw from these observations the conclusion that the rabbits had suffered from typical rachitis and, as the gestation and suckling periods had been normal and the animals had been kept under the most favourable conditions, while the digestive troubles had commenced only shortly before death, they attribute it to the thyroidectomy practised on the parent rabbits.

It is consequently possible that a hereditary thyroid insufficiency may be a cause of rachitis.

140 - **Metabolism during Pregnancy and the Lactation Period.** - DIENES, LUDWIG in *Biochemische Zeitschrift*, Vol. 55, Part 1-2, pp. 124-133. Berlin, September 12, 1913.

A communication of the results of experiments on the metabolism taking place in a bitch during pregnancy and before and after the lactation period. The metabolism appears to decrease slightly in the middle of the term of pregnancy, while it increases considerably during the second half of the time. During lactation, it is much more active than during pregnancy. During the lactation period, the mother and young expend the same amount of energy per surface unit. With the cessation of lactation, the expenditure of energy rapidly decreases again.

141 - **The Digestion of Crude Fibre by Sheep and Pigs.** — ANGERLING, BRETSCH, LÖSCHE and ARNDT in *Die landwirtschaftlichen Versuchstationen*, Vol. 83, Part III—IV, pp. 181-210. Berlin, December 23, 1913. FEEDS AND FEEDING.

The authors experimented upon two wethers and two improved Meissen pigs, with "digested" straw, young grass and wheat chaff. The "digested" straw was prepared by boiling straw under pressure in an alkaline liquid; it thus contains a less lignified crude fibre. In the wheat chaff the crude fibre was much lignified and permeated by encrusting matter. In this latter respect grass occupied an intermediate position between "digested" straw and chaff.

The arrangement of the experiment and the rations fed daily per head during the experiment are shown in Table I.

The additions of "digested" straw, grass and chaff to the basal ration were made in small quantities at the beginning of each period and only towards the end in the full quantity. This was done in order to accustom the animals gradually to the new food. Each period lasted 11 days and commenced after a preparatory period of several days. Samples of the dung of the animals were collected daily, and examined at the end of the period. The examination of the food and the dung was carried ont according to

TABLE I.

Designation of feeding period	Wethers	Pigs
1. Basal ration . . .	700 grams meadow hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt.	1000 gms. barley groats + 250 gms. fish meal + 10 gms. salt.
2. "Digested" straw.	700 gms. hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt + up to 600 gms. "digested" straw.	1000 gms. barley groats + 250 gms. fish meal + 10 gms. salt + up to 600 gms. "digested" straw.
3. Grass *	350 gms. hay + 50 gms gluten + 125 gms. starch + 10 gms. salt + up to 1500 gms. grass.	500 gms. barley groats + 100 gms. fish meal + up to 1500 gms. grass.
4. Wheat chaff . . .	700 gms. hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt + up to 250 gms. wheat chaff.	1000 gms. barley groats + 250 gms. fish meal + 10 gms. salt + up to 250 gms. wheat chaff.

* In this period only half the basal ration was fed, as it was feared that without this precaution the pigs would not consume the grass; but this fear was found to be groundless.

TABLE II.

	Dry matter %	Organic matter %	Crude protein %	Nitrogen free extract %	Fat %	Crude fibre %	Pure protein %	Ash %
				"Digested" straw.				
Wethers . .	72.65	73.19	—	72.23	—	77.27	—	55.20
Pigs	101.22	88.85	—	63.75	—	94.81	—	—
				Grass.				
Wethers . .	65.29	69.77	76.85	67.29	66.93	69.49	74.05	37.68
Pigs	49.58	51.86	52.05	52.07	84.35	39.39	47.32	35.92
				Wheat chaff.				
Wethers . .	40.33	46.93	55.56	51.54	—	30.34	47.67	19.86
Pigs	20.53	22.95	—	27.86	—	—	—	12.85

the methods adopted at the Mockern and Hohenheim (Germany) Experiment Stations.

The average digestion coefficients for the three fodders experimented upon are given in Table II.

It will be seen from the above that the pigs digested the crude fibre which was not or only slightly lignified better than the sheep, while the latter were able to utilize better the crude fibre more or less permeated with encrusting matter. The better utilization of the crude fibre of " digested " straw by pigs depends partly upon the fact that with the sheep some of the crude fibre of the basal ration escapes digestion. It can therefore hardly be stated that pigs are superior to ruminants in their power of dissolving pure cellulose.

The pigs digested 39.39 per cent. of the cellulose of grass, but they were not able to attack that of wheat chaff, the reason of this difference being that the incrustations are less readily dissolved in the alimentary canal of pigs than in that of ruminants. The superiority of ruminants as regards the power of dissolving cellulose in young grass and in wheat chaff is very probably due to the finer division obtained by better mastication and to a more intense fermentation of the food in the digestive organs.

Summarizing the results, it may be said that pigs are as capable as ruminants of dissolving pure crude fibre or that containing but little encrusting matter, but lose this power in proportion as the encrustation or lignification of the crude fibre increases.

142 - **The Influence of Butter-fat on Growth.** — OSBORNE, T. B. and MENDEL, L. B. (Connecticut Agr. Exp. Station and Yale Univirsity) in *The Journal of Biological Chemistry*, Vol. XVI, No. 3, pp. 423-437. Baltimore, December 1913.

In previous papers (1) the writers showed that the substitution of unsalted butter for part of the lard in a "protein-free milk" food (consisting of protein, starch, " protein-free milk " or its equivalent, and lard) would cause rats to grow normally even if previous malnutrition had arrested development. In the present investigations pure butter-fat was substituted for butter in order to determine whether it contained the active principle.

The pure butter-fat was isolated from the butter by centrifuging the latter at 45° C. for about an hour. At the end of that time the clear melted fat forming the upper layer in the flask was quite free from all impurities, the aqueous solution containing lactose, etc., and the solid matter present in the butter having collected below. The fat was pipetted off and introduced into the daily rations which were made up as follows :

Protein	18 per cent.
Starch	26 » »
« Protein-free milk »	28 » »
Lard	10 » »
Butter-fat	18 » »

(1) See No. 1171, *B*. Oct. 1913. (*Ed.*).

In every case normal growth was obtained on this diet and rats whose weights were decreasing on a " protein-free milk " food immediately recovered.

As the pure butter fat contains no trace of nitrogen, phosphorus or ash, its efficiency in promoting growth cannot be attributed to the presence of nitrogen or phosphorus containing bodies such as lecithin, phosphatides, etc., nor to inorganic salts. Investigations as to the essential difference between butter-fat and lard are being pursued and include the comparative study of a number of other fats.

143 – **The Nutritive Value of Potato Distiller's Slop and of the Substances from which it is Made.** — VÖLTZ, ZUNTZ, VON DER HEIDE and KLEIN in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 681-832. Berlin, 1913.

There being no reliable data on the nutritive value of potato distillers' slop in comparison to the substances from which it is derived, the writers started an exhaustive investigation into the subject. Already several experiments have been carried out, some being on the digestibility and fermentation of the food in the digestive organs and the others on the exchanges of gas taking place with this feed. The animals chosen for the former experiments were three wethers, and for the latter a 4-year-old steer.

For the better carrying out of the experiments the writers prepared dried potatoes and dried slop. The materials for the slop consisted of 2420 lbs. potatoes (Walthmann variety) containing 18.5 per cent. of starch, 110 lbs. malt and 0.66 lb. yeast. The mash was allowed to ferment to 1° Balling. The other food was prepared by cooking together to a pulp 2420 lbs. of potatoes (Walthmann) containing 18.5 per cent. of starch, 110 lbs. malt and 0.66 lb. yeast, and drying.

The loss of energy that the materials underwent by being transformed into slop averaged 68.8 per cent., so that the slop contained 31.2 per cent. of the calories of the original materials. On analysis it was found that by the preparation of the slop, about one-third of the amides of the original matter had been transformed into yeast protein.

I. *Experiments on Sheep.*

The experiments on the sheep were arranged as shown in Table I.

By feeding potato starch (as a substitute for the loss of energy caused by fermentation) with slop, the writers wished to ascertain how changes brought about by the preparation of the slop, especially in the nitrogenous nutritive matter, act upon the digestion. The only object of feeding lentils was to determine their nutritive value as a concentrated food. In order to determine which ration caused the greatest feeling of thirst, an account was kept of the quantities of water taken and lost. The dung of the animals was always examined fresh. In order to corroborate the results of the experiments on wethers, the writers undertook some on rats also. All the experiments were preceded by a preparatory period of 6 or 7 days.

The results of the experiments gave the following the average digestive values in the three basal ration periods:

Organic matter	60 %	Crude fibre	67 %
Crude protein	56 »	Nitrogen-free extract . .	59 »
Cude fat	33 »	Calories	56 »

TABLE I.

Sheep No.	Period	Duration of Period. Days	Average consumption of food per day
1	1. Basal ration	8	700 grams hay.
	2. Slop + starch	6	700 gms. hay + 75.46 gms. slop + 198.4 gms. potato starch.
2	1. Basal ration	8	700 gms. hay.
	2. Potatoes + malt + yeast	8	700 gms. hay + 250 (potatoes + malt + hay).
	3. Slop + starch	8	700 gms. hay + 75.46 gms. slop + 198.4 gms. potato starch.
	4. Slop	8	700 gms. hay + 250 gms. slop.
3	1. Basal ration	7	700 gms. hay.
	2. Potatoes + malt + yeast	8	700 gms. hay + 250 gms. (potatoes + malt + yeast).
	3. Slop	8	700 gms. hay + 250 gms. slop.
	4. Lentils	8	700 gms. hay + 250 gms. lentils

The physiological utilization value of hay was 45 per cent. and the examination of the dung showed approximately nitrogen equilibrium. The digestive values agree with those previously obtained by the writers. The daily amount of water taken was 1.94 quarts per head and stood to the dry matter consumed as 3.4 : 1.

The two potato + malt + yeast periods compared with the basal ration periods showed a great depression of the percentages of digestion of crude fibre and crude protein. These were respectively 24 per cent. and 14 per cent., and were very probably a consequence of the very low protein content and high soluble carbohydrate content of the ration.

For the mixture: potatoes + malt + yeast, the following digestion values were determined:

Organic matter	69 %	Nitrogen-free org. matter	74 %
Crude protein	20 »	Calories	67 »

The physiological utilization value of the mixture was 65 per cent.; the assimilation of nitrogen by 1000 lbs. live-weight was 26.54 gms. per day. The amount of water taken was 2.49 quarts per head and day and stood to the consumption of dry matter as 3.2 : 1.

The two slop + starch periods showed in comparison to the basal ration periods a lower digestion of the crude protein and crude fibre of the ration: 8.9 and 7.5 per cent. respectively. It follows that the nitrogenous nutritive substances were deeply modified by the preparation of the slop. The digestibility of the crude protein and crude fibre was, however, better here than in the potato + malt + yeast periods, which the writers attribute to the former ration being a better medium for the intestinal flora than the latter.

The digestibility of the mixture slop + starch was the following:

Organic matter	86 %	Nitrogen-free org. matter	91 %
Crude protein	27 »	Calories	83 »

The physiological utilization value of the mixture slop + starch was 70 per cent., and was 5 per cent. higher than that of the mixture potatoes + malt + yeast. The nitrogen assimilation was 35.81 gms. per 1000 lbs. live-weight. The water taken up was 2.29 quarts per head and per day and stood in the ratio of 3 : 1 to the consumption of dry matter.

The two slop periods gave the following digestion values:

Organic matter	84 %	Nitrogen-free organic matter	94 %
Crude protein	61 »	Calories	84 »

For the nitrogen-free extract a digestion value of 114 per cent. was found, which is to be attributed to the nitrogen-free extract of the hay being more digestible when fed with slop than when fed alone. This fact, according to the writers, is less to be attributed to a specific action of the slop than to a better adaptation of the microflora in the alimentary canal consequent upon the preceding feeding with hay.

The physiological utilization of slop was 69 per cent., and the assimilation of nitrogen 29.45 gms. per 1000 lbs. live-weight. The water taken up was 3.42 quarts per head and day and the ratio to the dry substance taken up was as 4.4 : 1.

The lentil period gave the following digestion values:

Organic matter	85 %	Crude fibre	52 %
Crude protein	79 »	Nitrogen-free extract	90 »
Crude fat	63 »	Calories	84 »

The physiological utilization value was 62 per cent. and the nitrogen assimilated was 20.13 gms. per 1000 lbs. live-weight per day. The water taken up was 2.91 quarts and the ratio to the dry matter as 3.8 : 1.

These digestion values agree nearly with those of beans.

From the digestion experiments on rats the conclusion may be drawn that the digestibility of the material for the preparation of slop is not inferior to the slop plus an isodynamic amount of potato starch to replace the loss by fermentation. The digestion values for lentils obtained by the experiment on rats were approximately the same as those obtained with sheep.

The writers draw from these experiments the following conclusions:

1. The slop causes a greater sense of thirst than the materials from which it is prepared; this is chiefly due to its high content of potash salts. It is, however, possible that slop contains specific thirst-exciting substances.

The addition of common salt as well as the dilution and neutralization of slop is not to be recommended. It should besides be fed warm rather than cold.

2. The nitrogenous nutritive matter of slop seems, notwithstanding its high protein content, to possess no higher nutritive effect than the nitrogenous foods rich in amides from which it is derived. From this it may be concluded that the amides of the feeds are to be included among the nitrogenous nutriments as well as proteins.

3. The digestibility of slop is considerably greater than has been hitherto generally accepted. Kellner set the digestibility of crude protein in slop at 50 per cent. and that of the organic matter at 58 per cent., while the experiments of the writers give the above values at 61 and 84 per cent. respectively. If the slop and the material from which it is derived are calculated according to Kellner's values for starch and digestible crude protein, their value works out to 1*s* 9*d* per cwt. for the material and to 7 ¼*d* per cwt. for the amount of slop made out of 1 cwt. of the same material. The cash value of the slop would thus be about one-third that of the material whence it was derived. But it has been shown that, chiefly through a low protein content of the ration, only 20 per cent. of the crude protein and 74 per cent. of the nitrogen-free organic matter of the material are digested, while with feeds richer in protein, 51 per cent. of the protein of potatoes and up to 90 per cent. of the nitrogen-free organic matter are digestible. If now these latter figures are introduced into the calculations instead of the former, the value of the material would be 2*s* 1.58*d* per cwt. instead of 1*s* 9*d*. In this case the value of the slop would only be about one-quarter of that of the material from which it was made. It is thus seen that the ratio of value between the material and the resulting slop has a considerable range, and that it depends to a great extent upon the composition of the ration. The writers cannot endorse the generally accepted opinion that the starch value of a food under varying conditions of feeding corresponds to the same nutritive value.

II. Experiments with a steer.

The experiments made with a steer were arranged as follows:

Period	Daily consumption of food
1. Basal ration	17.6 lbs. of hay
2. Potatoes + malt + yeast	15.4 lbs. of hay + 5.5 (potatoes + malt + yeast).
3. Slop + starch	15.4 lbs. of hay + 754.6 gms. slop + 1.984 gms. starch
4. Slop	15.4 lbs of hay + 5.34 lbs. of slop.

Each experiment lasted 16 days and was commenced after a preparatory period of 8 days. On the first and last day of each period the animal was kept in a Regnault Reiset's respiratory calorimeter. The most important results of these experiments, which are to be continued, may be summarized as follows: In the utilization of the rations no great differences were observed between the steer and the sheep. The nutritive matter was digested somewhat better by the steer, while the additions to the hay were better utilized by the sheep. From the respiratory experiments it was seen that the most insignificant changes in the composition of the food influenced the fermentation process in the paunch and consequently the results of the feeding. Also the quantity of the aromatic compounds that passed into the urine varied with the composition of the food. The writers conclude from this that the starch value of a food calculated according to Kellner can differ very much from the one found by a respitatory experiment. The quantity of carbonic acid evolved by the fermentation process in the intestines amounted often to upwards of one-third of all the carbonic acid emitted by the animal, from which it may be inferred that the determination of the quantity of carbonic acid alone is no sure test of the metabolism of ruminants.

BREEDING

144 — **Colour Inheritance in the Horse** (1). — WENTWORTH, E. N. (Ames, Iowa) in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. II, No. 1-2. pp. 10-17. Berlin, November 1913.

Microscopic examination and simple chemical tests show that only two pigments are concerned in the coat colour of horses: 1) red pigment distinct from the yellow ground pigment present in all coloured hairs, and 2) black pigment, which masks the red colour. Quantitative differences occur with regard to the amount of pigment present, thus producing the dilute colours.

The writer suggests a new scheme of factors (see below) which differs from that of most modern investigators in not attempting to arrange all the colours as an epistatic and hypostatic series of simple factors.

C = red pigment or yellow basic pigment.
H = black pigment.
B = a restriction factor, producing bay in presence of H.
G = grey pattern.
R = roan pattern.
D = dappling factor.
S = white blaze on forehead and white legs.
P = piebald and skewbald markings.
M = creamy yellow mane and tail.
I = dilution factor.

According to this scheme: *Chestnut* should contain C and might in some cases also contain B and M; *black* contains C H and may have D in some cases; *mouse* contains C H I, with the possible addition of D; *dun* contains

(1) See No. 1355, *B.* Dec. 1913. *(Ed.)*.

CI, CBI, or C M I; *bay* contains CHB; *brown* contains CHBD; *gray* contains CHGD or possibly CGD; *blue roan* contains CHR; and *red roan* contains CR or CHBR.

The writer discusses the scheme in reference to all available records — viz: Sturtevant's, Wilson's and Anderson's tables, together with his own personal observations.

145 — **A Cross involving Four Pairs of Mendelian Characters in Mice.** — LITTLE, C. C. and PHILLIPS, J. C. in *The American Naturalist*, Vol. XLVII, No. 564, pp. 760-762. Lancaster, Pa., December 1913.

The writers state that the experiments recorded in the above article were planned as a control to more detailed investigations being carried out at the Bussey Institution. The four pairs of characters in question were as follows:

A = agouti,	a = non agouti.
B = black,	b = no black (brown).
D = density,	d = diluteness.
P = dark eye,	p = pink eye.

A wild grey mouse of the gametic formula $A\ B\ D\ P$ was crossed with a pink-eyed dilute brown mouse of the formula $a\ b\ d\ p$. The F_1 generation all resembled the wild parent and were mated *inter se*, producing 1180 F_2 individuals. These split up into 16 different groups and gave numbers in good accord with the expected.

Both when each allelomorphic pair is considered separately and when the results are taken as a whole, animals possessing dominant characters show a slight excess over the expected numbers, but this is not sufficient to support any theory of coupling, and may be due to selective elimination, as the first observatious were made when the mice were already four weeks old.

146 – **Heredity and Regeneration of the Testis in Birds.** — BOND, C. J. in *Journal of Genetics*, Vol. 3, No. 2, pp. 131-139, plates IV and V, figs. 1-9. Cambridge, September 1913.

The writer performed orchectomy on fowls and pigeons and observed regeneration of the gamete-bearing tissue. Experiments were then carried out to ascertain whether the gametes which are formed in this regenerated tissue resemble in their hereditary characters the gametes which are formed by the original gland before removal. In these experiments birds of known genetic composition were used and the cocks were mated with the same hens throughout the experiments.

The offspring of a Brown Leghorn cockerel were of the same type before and after castration. Those of a male Blue Chequer Fantail pigeon were identical in plumage, but among the young hatched before castration none showed any feathers on the toes, whereas out of the 17 hatched after regeneration of the testis 4 showed signs of feathered tarsi. A male Black-and-White Fantail pigeon mated with an Almond-and-White sister produced before castration, 10 young, of which only one was white. After castration and regeneration of the testes the same pair produced 34 young pigeons of which 7 were white.

It would therefore appear that the Leghorn cockerel was homozygous in respect of colour, that is to say that only one kind of gamete was being produced before castration. There is no reason then to expect that the increased production of spermatozoa during regeneration of the testes would result in the production of gametes of a different kind. On the other hand it seems likely that in a sex gland where gametes of different factorial composition are being produced, the temporarily arrested and subsequently increased cell division might result in a different rate or order of production of the different kinds of gametes being formed in that particular organ.

The writer suggests further experiments on the removal and regeneration of the sexual glands of fowls of both sexes which are known to be producing gametes of two kinds only. With confirmation of his results, he considers that a detailed study of the changes in cell division during regeneration of the sperm mother-cells may throw much light on certain results in breeding which seem to be inconsistent with Mendelian expectation. Many apparent anomalies may owe their existence to some change in the rate of reproduction of gametes of different kinds in that particular sex gland.

147 - **On the Zygotic Constitution of Dominant and Recessive Whites in the Silkworm, *Bombyx mori* L.** — Toyama, K. and Mori, S. in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. 10, No. 3, pp. 232-241. Berlin, July 1914.

Earlier researches of one of the writers (1) led him to conclude that there must be two kinds of white silkworms, one dominant and the other recessive to coloured breeds. In order to investigate the matter further, a cross was made in the spring of 1911 between females of the Japanese divoltine white (Yamato-nishiki) and males of the European white (sina blanc), both of them being white cocooners sometimes faintly shaded with greenish yellow, and breeding true to type. Nine matings gave 2 344 cocoons, all white but showing a variation of shading up to light greenish yellow like the parents. This F_1 generation was divided into nine classes according to shading, and moths derived from each class were paired *inter se*. The F_2 generation consisted of 17 661 individuals, and in every class whites and yellows appeared in the ratio of 13 white to 3 yellow. These results indicate that two pairs of Mendelian characters are involved, *viz*. *Ss* presence and absence of a colour-inhibiting factor, and *Yy* presence and absence of yellow colour, and that the parents were *SSyy* and *ssyy* respectively.

The writers point out that with this scheme five different kinds of white individuals may be obtained, indistinguishable by their outward appearance, *viz*. *SSYY*, *SSyy*, *ssyy*, *SSYy*, *Ssyy*, and that this may account for the rather conflicting results previously obtained in certain silkworm crosses.

(1) Toyama, K. On the varying dominance of certain white breeds of the silkworm, *Bombyx mori* L. — *Zeitschr f. induktive Abst- u. Vererbungslehre*, Vol. 7, 1912.
Id. On certain characteristics of the silkworm which are apparently non-Mendelian. — *Biolog. Centralblatt*, Vol. 32, 1912.

148 - **Non Disjunction of the Sex Chromosomes of *Drosophila*.** — BRIDGES, C. B. (Columbia University), in *The Journal of Experimental Zoology*, Vol. 5, No. 4, pp. 587-605. Philadelphia, November 1913.

During the course of his breeding experiments on *Drosophila*, the writer repeatedly met with a certain kind of exception to the ordinary rules of sex-limited inheritance, which led him to conclude that with some female parents non-disjunction occurred in a certain percentage of the maturations, *i. e.* ova were formed which contained two sex-chromosomes instead of the normal one, while other corresponding ova contained no sex-chromosome. He discusses the application of partial sex-limited inheritance to these cases and shows that the hypothesis does not fit his results.

149 - **Comparative Digestion Experiments on Equidae.** — FRANK, O. in *Kühn-Archiv*, Vol. 3, Half - vol. 2, pp. 363-396. Berlin, 1913. HORSES, ASSES AND MULES

The writer conducted a series of digestion experiments, at the beginning of the year 1913, at the Agricultural Institute of the University of Halle a. H., with the object of ascertaining whether a different power of utilizing food existed in horses, asses and their hybrids. The animals used were a gelding and a mare, a jack and a female ass, two mules (a gelding and a female) and two hinnies (a gelding and a female).

The mare was of the Mongolian breed, while the gelding possessed much Belgian blood. The writer purposely selected two distant breeds of horses in order to ascertain incidentally how the extreme country and improved breeds behaved as to the utilization of food. The other groups could be considered as nearly uniform.

In order to simplify matters, the food used consisted only of hay and oats, and they were fed mixed. Their chemical composition was the following:

	Dry matter	Nitrogen	Crude protein	Crude fat	Crude fibre	Nitrogen free extract	Ash
	%	%	%	%	%	%	%
Hay	84.28	1.20	7.50	1.49	28.76	40.24	6.29
Oats	86.255	2.015	12.59	3.535	10.805	56.675	2.65

The daily rations at first were 10 lbs. hay and 10 lbs. oats per 1000 lbs. live-weight. It soon appeared, however, that this was too much and only so much was given to each animal as it could eat. Water was provided *ad lib.* Each experiment lasted 10 days and was preceded by a preparatory period of 7 days. During the 10 days the excrement of each of the animals was collected and one-thousandth of it weighed and examined. The animals were kept in a stable which allowed of a perfect collection of the excre-

ment. In the determination of the nutritive matter the following methods were followed:

Dry matter: by difference in the esiccator.
Ash: by ignition.
Nitrogen and crude protein: by Kjeldahl's method.
Crude fat: by Soxhlet's »
Crude fibre: by Holdefleiss' »
Nitrogen-free extract: Indirectly by difference.

The digestion coefficients for the several animals are given in the following table.

	Dry matter	Crude protein	Crude fat	Crude fibre	Ash	Nitrogen-free extract
	%	%	%	%	%	%
Jack	63.04	65.01	39.35	39.56	34.32	76.10
She ass	67.53	66.41	49.09	49.05	20.42	80.25
Hinny gelding	71.72	73.50	51.12	46.53	37.90	85.54
Hinny mare	66.06	66.57	61.79	46.16	32.20	77.42
Gelding	62.32	71.08	34.51	37.82	28.81	74.59
Mare	67.10	70.73	42.39	45.46	31.04	79.79
Mule gelding	64.04	66.47	39.20	43.48	39.71	75.87
Mule mare	63.00	58.87	39.78	49.06	35.53	76.83

From the above it appears that there are notable differences in the utilization of food among the various animals. Among the horses, the mare, belonging to a thrifty country breed, digested the food, with the exception of crude protein, better than the gelding belonging to an exacting breed. The latter was distinguished by a high utilization of crude protein, in which it was surpassed only by the hinny gelding. In the utilization of crude fibre, crude fat and nitrogen-free extract the mules and hinnies were superior to the gelding and inferior to the mare.

The experiment justified the conclusion that thrifty breeds of horses can compete in thriftiness with mules. The statement of Sanson that mules are less exacting than horses, because they can utilize raw protein better, is not borne out by these experiments.

The writer has also calculated how much food each animal took up per unit of surface, and found that the opinion that the smaller the animal, the greater the energy it requires to keep up its vital processes, was confirmed.

150 - **The South Oldenburg Horse and the Economic Conditions of its District.** — BURMESTER, HARALD in *Kühn-Archiv*, Vol. 3, Half—Vol. 2, pp. 397-505. Berlin, 1913.

This work contains exhaustive data on the soil, water, and climate of South Oldenburg, as well as on the density of population, utilization of soil, and conditions of proprietorship and of means of communication. It treats then of the general development of horse breeding from its commencement down to the present time and of the ancestry of the breed itself. In the last section of the work the writer discusses the development of the breed with the aid of measurements carried out on 615 breeding animals.

151 - **Colour in Shorthorn Cattle** (1). — WENTWORTH, E. N. (Ames, Iowa) in *The American Breeders' Magazine*, Vol. IV, No. 4, pp. 202-208. Washington, December 1913. CATTLE

The hypothesis that roan cattle are the simple heterozygotes of a red and white cross has been shown to be only very approximately verified by the breeding records of Shorthorns. The writer suggests that two Mendelian factors are involved instead of one, *viz.* *Rr*, presence and absence of red pigmentation, and *Pp*, presence and absence of roan "pattern" or arrangement of hairs.

The records of the Iowa State College Herd show that individuals which must have been pure homozygous reds, *RRpp*, and homozygous whites of the constitution *rrPP*, when mated together gave an F_1 generation all roan and an F_2 generation made up of:

36 roan, 11 red, 17 white (9 : 3 : 4 ratio);

while roans, which from their records were apparently of the two types *RRPp* and *Rr PP*, gave the following results:

RRPp bred *inter se*	gave	10 roan	4 red
RrPP » »	»	8 »	2 white
RRPp × *RrPP*	»	8 roans	
RRPp × *RrPp*	»	3 »	1 red
RrPP × »	»	4 »	2 white.

The writer then discusses the white markings found on both red and roan animals, and considers that these are quite distinct from the roan "pattern".

According to the above scheme of inheritance, and if reds and red-and-whites are grouped together in one class, then reds mated to reds can never produce roans, and whites to whites can only produce whites.

The writer has gathered breeding records together from various sources and tabulates them, but the latter show serious discrepancies with the expected results. On following up a large number of the discordant cases, however, he has been able to prove that they were wrongly classed in the records, and it therefore seems likely that the other discordant cases may be due to similar errors.

(1) See No. 525, *B.* March 1912. (*Ed.*).

152 - **The Influence of Feeds on the Quantity and Fat and Bacterial Content of Milk.** — LUCAS, J. E. in *L'Industrie Laitière*, Year 38, No. 47, pp. 752-761. Paris, November 23, 1913.

The writer conducted a feeding experiment on 21 cows of equal milk yield, with the object of determining by comparison the influence of moist and dry feeding on the quantity, fat content and bacteria of the milk. Earthnut cake, wet and dry, and mangolds, whole and sliced, were fed. The daily ration, which was the same for all the animals, consisted of 99 lbs. mangolds, 6.6 lbs. chaff, 11 lbs. lucerne hay, 3.3 lbs. maize gluten, 3.3 lbs. earthnut cake and 3.3 lbs. wheat bran.

The experiment was divided into a preparatory and a transition period, then the experiment proper and lastly a closing period, and the cows were divided into three groups.

The cake and mangolds were fed as follows:

Preparatory period: 14 days......	Group I » II » III	wet cake, sliced mangolds.
Transition period: 8 days.........	Group I » II » III	: wet cake, sliced mangolds. : dry » whole » : dry » sliced »
Experiment proper: 30 days......	Group I » II » III	: wet cake, sliced mangolds. : dry » whole » : dry » sliced »
Closing period: 14 days	Group I » II » III	wet cake, sliced mangolds.

The feeds were weighed daily, separately for each group and at the same time. Immediately after each milking, which also was done at the same time, the milk and fat yield of each cow were determined, and seven times during the whole experiment a sample of milk was taken in the morning and in the evening under aseptic conditions, from each group, and examined as to its content in bacteria. The cows averaged 1100 lbs. in weight and were all kept in the same stable.

The result was that the performance of the three groups did not differ sensibly from each other in milk yield and fat content during the whole experiment.

In the bacterial content no striking difference was observed in the milk of the three groups. It seemed, however, that the moist feeds were somewhat more favourable to the development of the milk flora than the dry feeds.

The writer concludes that with the exception of a slightly higher milk yield from the groups fed on whole mangolds, feeding wet or dry had next to no influence on the quantiy of the milk and on its fat or bacterial content.

153 - **The Zackel Sheep in Bosnia and Herzegovina** (1). — MEHMEDBASIC, MAHMUT in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. 2, Part 2, pp. 307-330. Vienna, November 29, 1913. SHEEP

This paper is a very exhaustive study on the breeding of Zackel sheep in the districts of Gacko, Stolac and Travnik in Bosnia-Herzegovina. It contains data on the natural conditions of production of the land, on the outer conformation of the body and on the skull, on the fleece and on the wool of these sheep, on the manner of breeding them and utilizing them (wool, milk, flesh) and also on the economic importance of the flocks. As an appendix to the paper the writer gives in six tables the measurements of the skeleton and of the wool made on 60 animals. He concludes that there are three breeds of Zackel sheep, the chief exterior distinctions of which are the weight of the horns and the length of the wool. The heaviest horns and the longest wool are found in the Vlasic (Travnik) sheep and the lightest horns and shortest wool in the Stolac flocks, while the Gacko sheep are intermediate. For the improvement of the breeds he recommends selection and pure breeding.

154 - **Pig Fattening Experiments with Manioc Roots** (2). — FRATEUR, J. L. and MOLHAUT, A. in *Laiterie et Élevage*, Year 8, No 11, pp. 81-88. Louvain, November 1913. PIGS

The writers carried out for the Ministry of the Colonies two fattening experiments with manioc in order to test its value as food for pigs.

Experiment I was made on a lot of 5 pigs and Experiment II on two lots of 5 each. The animals of lot 1 were of the local breed. Those of lot 2 were crosses of the local breed and Yorkshires. Lot 3 consisted of pigs of the improved local breed. In lot 1 the pigs were full grown and in the other two lots they were still growing. The rations for lot 1 were composed of manioc and pollards in equal quantities and some mangold slices and meat meal. Lots 2 and 3 were fed manioc and pollards in equal parts and skimmed milk. As much manioc and pollard mixture was fed as the animals could eat. The skimmed milk was given throughout the whole experiment in nearly the same quantity. The animals were fed morning and evening, and the food for each lot was weighed daily.

The Experiment on lot 1 lasted 77 days and on lots 2 and 3, 58 days. The preliminary periods were 28 and 19 days respectively. As the pigs of the last two lots accustomed themselves from the beginning to the new food, the preparatory period was shortened. The pigs of lot 1 up to the 38th day of the experiment were fed manioc as raw meal mixed with the other food, but as their appetite soon diminished the cassava roots were steeped in water for 24 hours and then boiled and mashed to a pulp before being fed. After this change the appetite of this lot kept normal and only diminished gradually towards the close of the experiment. During the experiment they received an average of 4.44 lbs. manioc, 4.44 lbs. pollards, 3.52 lbs. mangolds and 0.40 lb. meat meal.

(1) See Original Article, p. 680, *B.* May 1913. (*Ed.*).
(2) See No. 1173, *B.* Oct. 1913. (*Ed.*).

Lots 2 and 3 were fed manioc reduced to pulp from the beginning; their appetite kept good all the time, only diminishing towards the end. Lot 2 were fed 3.25 lbs. of manioc, 3.25 lbs. of pollards 11 lbs. of skimmed milk per head per day and the pigs of lot 3, 2.70 lbs. of manioc, 2.70 lbs. of pollards and 11 lbs. of skimmed milk.

The results of the experiment were that all the animals were well fattened and some very well. Their flesh was savoury and had good keeping qualities; the fat was white and firm. The daily increases in live weight per head were: in lot 1, 1.303 lbs., in lot 2, 1.478 lbs. and in lot 3, 1.374 lbs.

POULTRY

155 - **Reciprocal Crosses between Reeves' Pheasant and the Common Ring-neck Pheasant Producing Unlike Hybrids.** — PHILLIPS, J. C. in *The American Naturalist*, Vol. XLVII, No. 563, pp. 701-704. Lancaster, Pa., November 1913.

In reciprocal crosses between *Syrmaticus recvesi* and *Phasianus torquatus*, two types of male hybrid were obtained according to the nature of the cross. The appearance of these two types is described.

FISH

156 - **Actinomycosis in Carp.** - PLEHN, M in *Allgemeine Fischerei-Zeitung*, Year 88, No. 24, pp. 624-625. Munich, December 15, 1913.

According to the investigations of the writer, this disease, which was first observed in goldfish, and is due to an *Actinomyces*, also attacks carp (1).

In the latter case, it progresses very slowly and it is some years before the function of the affected organ is hindered. If the fish is but slightly infested, its health does not suffer. In dissecting, macroscopic changes are only visible when the fish is entirely infested by the fungus; the microscope, however, reveals the initial stages of the disease. The parasite usually occurs in the peritonaeum, which, when the disease is far advanced, becomes inflamed and is seen to be thickened. This thickening is due to an abnormal deposit of fat in the peritonaeum. Often a similar fat deposit is also found in the lobes of the liver, and in the membrane covering the kidneys and air-bladder. The accumulation of fat in an organ can proceed so far as to make the fish quite dull and lethargic, and liable to die from the slightest injury. The fungus is probably taken up with vegetable food. The only known method of controlling this disease is the elimination from the breeding stock of all fish which have become abnormally fat upon a moderate diet. The consumption of fish affected by actinomycosis is not attended with any danger to mankind.

FARM ENGINEERING.

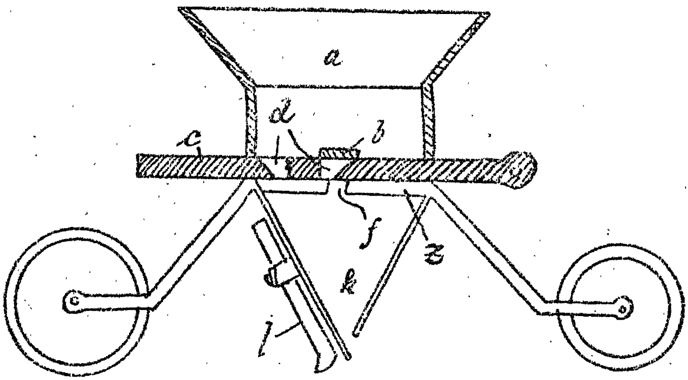
AGRICULTURAL MACHINERY AND IMPLEMENTS

157 - **New Beet-Seed Dibbling Machine (German Patent No. 552 166).** — *Blätter für Zuckerrübenbau*, Year 20, No, 24, p. 387. Berlin, December 31, 1913.

This beet-seed dibble consists of a frame mounted on wheels bearing a seed hopper (*a*) the bottom of which is formed by a plate (*z*) with an aper-

(1) See No. 722, *B*. June 1913. (*Ed*).

ture (*f*) through which the seed falls. At a short distance above this aperture a block (*b*) is situated and between this block and the bottom of the hopper a distributing slide is driven backwards and forwards. In the slide there are two openings (*d*) so arranged that they alternately drop the seeds at certain intervals through a funnel (*k*) into the furrow opened by the adjustable share (*l*).



New beet-seed dibbling machine.

158 - **Trials of Milking Machines in England (1913).** — *Mitteilungen des Verbandes landwirtschaftl. Maschinen Prüfungs-Anstalten*, Year 7, Part 4, pp. 129-153. Berlin, 1913.

In 1913 the Royal Agricultural Society of England organized a competition for milking machines in connection with the Show held at Bristol (1). The trials of the machines took place in April before the opening of the Show: the reports upon them are now printed. They include: 1) The report of the organizers. 2) The judges' report. 3) A report upon the milk samples from a bacteriological and chemical point or view.

The trials, for which the Royal Agricultural Society had offered gold and silver medals and prizes in money, were held at Grange Hill farm, Bishop Auckland, Durham.

The organizers' report contains the conditions of the trials and the special arrangements that had to be made owing to the great number of entries. The judges' report gives some introductory data, followed by short descriptions of the various machines and of the results obtained with them.

The ten following machines were tried:

1. Mjölkningsmaskin Omega, Flen, Sweden.
2. G. Bartram & Son, Melbourne, Australia.
3. Vaccar Ltd., London.
4. Lawrence Kennedy Ltd., Glasgow.

(1) See No. 1064, *B*. Sept. 1913. (*Ed.*).

5. Max Melkmaschinen Ges., Kopenhagen.
6. I. & R. Wallace, Castle Douglas, Scotland.
7. Gane Milking Machine Co., Auckland, New Zealand.
8. Nyeboe & Nissen, Kopenhagen.
9. Jens Nielsen, Kopenhagen.
10 Manus Milking Machine Co., Norrköping, Sweden.

The cows used for the trials, which lasted only six days, had not been milked with machines for two years. They did not suffer any injury from the trials.

The following are some comparative data on the results obtained with the Omega machine (First Prize) and with another competing machine. The two machines were tried on the same four cows. The following data refer only to the morning milking:

	Omega machine	Other machine
Average quantity of milk obtained per cow. . . .	19.35 lbs.	16.54 lbs.
Average strippings per cow	1.13 »	1.37 »
Duration of milking, including time for fitting on apparatus	6.75 min.	10.5 min.

The next are the results obtained with a Vaccar machine (Second Prize) from a notoriously hard milker:

	Vaccar machine	Other machine
Quantity of milk machine-milked	18.19 lbs.	17.94 lbs.
Strippings obtained by machine	2.72 »	5.23 »
Duration of milking	11 min.	13 min.

With the Manus machine the average per cow of the morning and evening milking was 31.53 lbs. and 2.99 lbs. strippings, and the time employed 11 $^{3}/_{8}$ minutes.

The Wallace machine is distinguished by its specially complete milking.

The third report deals with the bacteriology and chemistry of the milk samples and includes data on the keeping qualities of the samples and on their bacterial contents.

The report concludes with some hints for the makers of milking machines.

159 – **New Churn** (Austrian Patent No. 59977). — *Wiener Landwirtschaftliche Zeitung*, Year 63, No. 83, p. 944. Vienna, October 15, 1913.

Figs. 1 to 4 show this churn, in which the axis of rotation is at right angles to the axis of the churn itself, and which is provided with a butter-worker. The butter-working apparatus is mounted in a frame which can be put into the churn at right angles to its axis of rotation, so that the cylinders of the butter-worker run parallel to the axis of the churn, which is shown in *c*; *a* is its cover, and *b* the rotating beater. The cylinders of the butter-worker, *e*, are mounted in the frame *d*, which can be slipped

over the counter beaters *f*. The cylinders catch into each other by the geared wheels *h*, and may be worked by the crack handle *g*. As soon as the butter is made and the buttermilk drained off, the churn is so disposed that its axis and consequently the axis of the butter worked are horizontal. On turning the handle *g*, the butter that has fallen on the worker is squeezed through between the cylinders and worked. Then the churn is swung round 180 degrees in the direction shown by the arrow *i*, and the butter which had fallen through the cylinders at the first working and had collected on the side of the churn, is again worked by turning the crank handle in the opposite direction; this operation can be repeated as often as may be judged necessary.

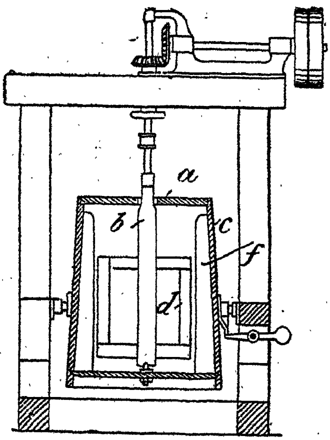


Fig. 1. – Churn during churning (vertical section).

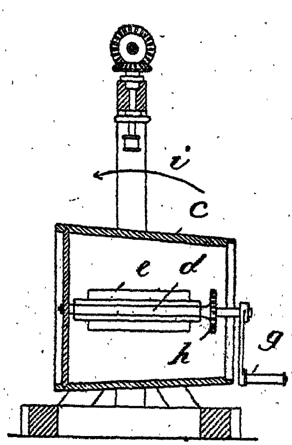


Fig. 2. – Vertical tangential section of churn, showing arrangement of butter-workers.

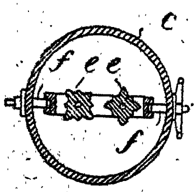


Fig. 3. – Section at right angles to that of fig. 2.

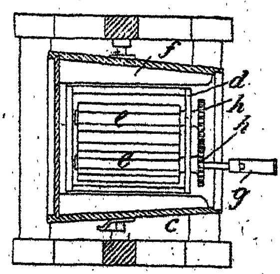
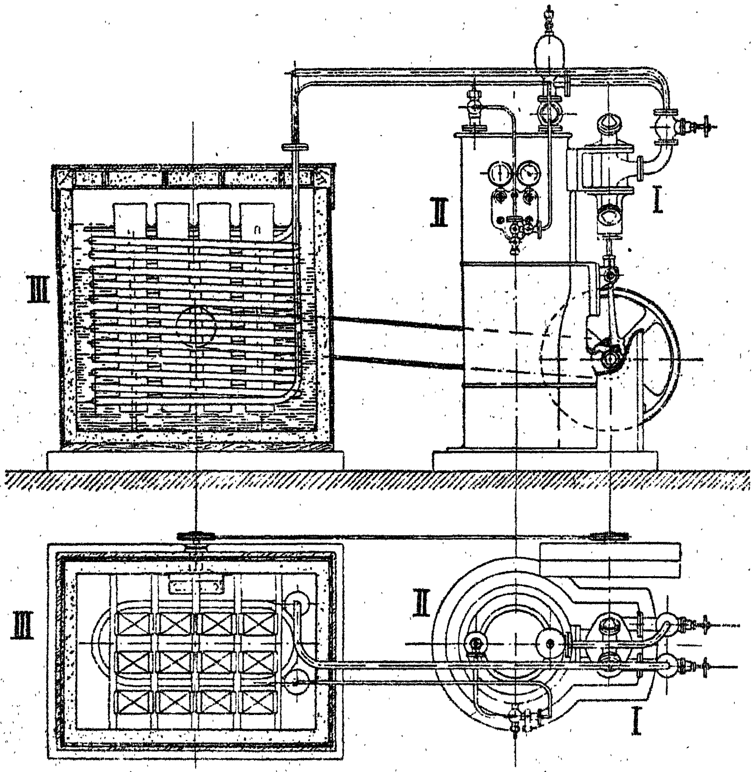


Fig. 4. – Horizontal section of churn.

160 - **Trial of a Refrigerating Installation.** — REZEK, I. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. 2, Part 1, pp. 1-16. Vienna, August 25 1913.

The trial of the whole refrigerating plant was carried out between May 12 and 19, inclusive, in the experiment-laboratory of the testing station for agricultural machines and implements of the College of Agriculture in Vienna.

The writer begins by a detailed description of this refrigerating plant and of its working. It is a steam refrigerator using sulphur dioxide and built



Refrigerator. — Elevation and plan.

chiefly for cooling purposes in dairies. The accompanying figures show the chief features of the ice machine, consisting of the compressor (I), the condenser (II) and the evaporator (III), which in this case is built in the ice generator. If the machine is not to be used for making ice, but for direct cooling of milk, the evaporating coil can be converted into a milk cooler over which the milk, without coming into contact with the sulphur dioxide, trickles along the coil containing the evaporating dioxide. Lastly, if the atmosphere of a milk room has to be cooled, the evaporating

coil is converted with a set of mostly cast iron ribbed pipes suspended from the ceiling of the chamber to be cooled.

The price of the refrigerator with ice generator amounts to £216 10s, and with milk cooler to £208.

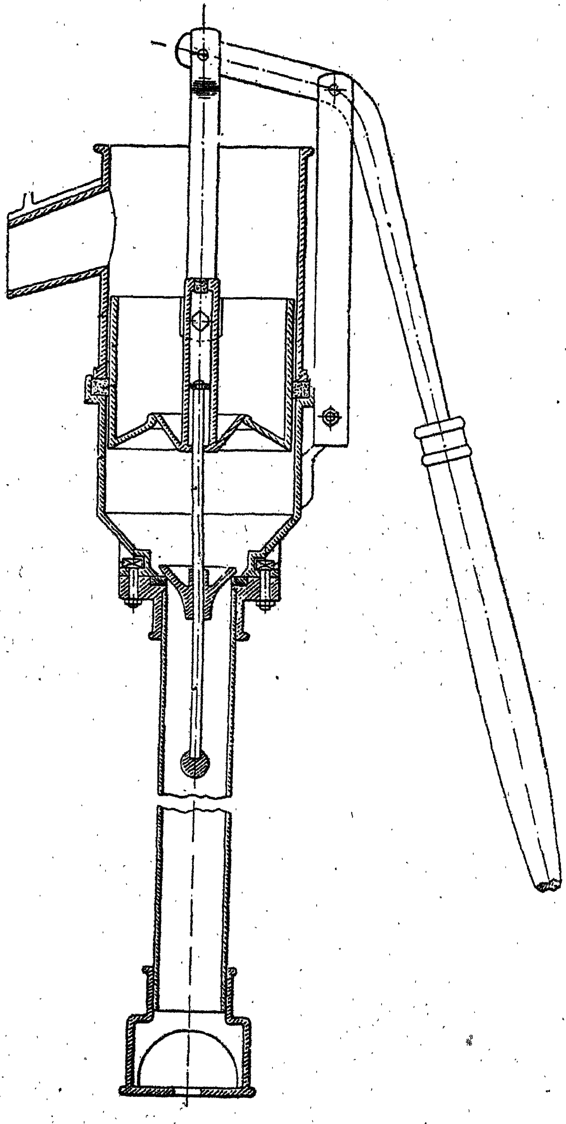
The writer then describes the experiments and their results, which are collected into tables. At first experiments were conducted during which the production of cold by the cooling plant was ascertained by means of brine in the ice generator. Then experiments were made as to its suitability for the production of ice and for the direct cooling of milk.

Lastly the writer illustrates the economic aspect of the above plant by the following table, which contains the most important data resulting from the trial.

Work done	Date	Consumption of power in HP.		Consumption of water for cooling at temperature given in brackets	Performance in calories per hour		
		by machine, including loss by transmission belting	by machine without loss by transmission belting		(a) Total	(b) per HP of motor	(c) per HP transmitted to compressor
				litres			
Cooling of the brine of the ice generator within the limits of — 2° to — 5° C.	12.V.1911	2.57	2.42	881 (10.7°C)	5000	1946	2066
	13.V.1911	2.45	2.36	860 (10.86°C)	5164	2108	2188
Production of ice from water at 12.4° C.	19.V.1911	2.26	2.14	900 (11.45°C)	2891	1277	1350
Cooling of a liquid by trickling over cooler.	12.V.1911	3.61	3.49	866 (10.53°C)	11714	3245	3356
	13.V.1911	3.12	3.03	886 (17.72°C)	9607	3079	3170

161 – **Trial of a Pump for Liquid Manure.** (11th Report of the Station for the Testing of Agricultural Machines and Implements at Hanover). – NACHTWEH, A. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 3, pp. 92-98. Berlin, 1913.

In the spring of 1911 one of these pumps for liquid manure was sent to the Hanover Machine-testing Station; since then it has been used on the Gleidingen estate near Hanover and subjected to a long trial of resistance.



Liquid-manure pump. — Vertical section.

The pump, the details of which are protected by patents, is built with the object of combining the greatest simplicity and deviation with the most uniform performance. Thanks to its large valve openings and ample pipes, choking is rendered impossible. The writer gives a detailed description of the pump, the vertical section of which is shown in the accompanying figure.

The writer gives the prices of these pumps according to the heights at which they deliver the liquid and he mentions also a series of portable pumps built on this system and worked by hand or power. The final verdict is to the effect that the pump can be described as useful, practical, and durable. It does not choke and performs its work well for a length of time.

162 – **Review of Patents.**

Manure Spreaders.

266 808 (Germany). Attachment with distributing wheel applicable to manure carts.
268 908 (Germany). Artificial manure spreader with oscillating hopper bottom.
60796 (Hungary). Manure spreader.
61 775 (Austria). Manure spreader.
255 883 (Belgium). Manure distributor.
460 888 (France). Manure distributor.
62 501 (Switzerland). Liquid manure distributor.

Sowing machines.

268 765 (Germany). Drill.
269 133 (Germany). Furrow-press for drills.
268 077 (Germany). Potato planter with bearing wheels transformed into planting wheels.
268 797 (Germany). Potato planter with hopper and separate funnel shaped receiver into which the potatoes fall and from which they are taken out by a series of clutches.
62 462 (Austria). Potato planter with shear-like clutches on planting wheel.
256 365 (Belgium). Potato planter.
60 745 (Hungary). Combined drill and hoe.
61225 (Hungary). Hand sower.
61 345 (Hungary). Sowing wheel for sowing machines.
61 516 (Hungary). Steering gear for sowing machines.
60 795 (Hungary). Device for emptying the hoppers of drills.
460 569 (France). Device for changing the speed for sowing machines.
16 408 (England). Potato planter.

Mowing and harvesting machines.

62 568 (Austria). Steering gear for vehicles, especially mowers.
61 194 (Hungary). Mower.
255 254 (Belgium). Mower with reaping attachment.
255 998 (Belgium). Improvement in mowers.
1 080 397 (United States). Windrower attachment for mowers.
460 958 (France). Windrower attachment for mowers.
460 998 (France). Reaper with reversible motion.
460 535 (France). Improvement in reapers.
24 872 (England). Harvesting machine.
62074 (Switzerland). Motor mower.
63 035 (Switzerland). Mower.

Root lifters.

268766 (Germany). Beet lifter with clutches consisting of forked levers on revolving disks.
62 071 (Austria). Hand beet lifter.
62 209 (Austria). Potato-lifter.
62260 (Austria). Two-row beet lifter.
62 261 (Austria). Potato lifter.
62 534 (Austria). Beet lifter.

62 860 (Austria). Throw wheel for potato-lifters.
60 571 (Hungary). Potato lifter.
255 501 (Belgium). Potato lifter.
255 456 (Belgium). Beet lifter.
22 685 (England). Potato digger.

Threshing machines.

61 906 (Austria). Thresher with straw press.
62859 (Austria). Attachment for removing chaff and short straw from thresher.
60857 (Hungary). Thresher elevator with guided motion.
255 223 (Belgium). Combined thresher and winnower.
129124 (Italy). Bean thresher.

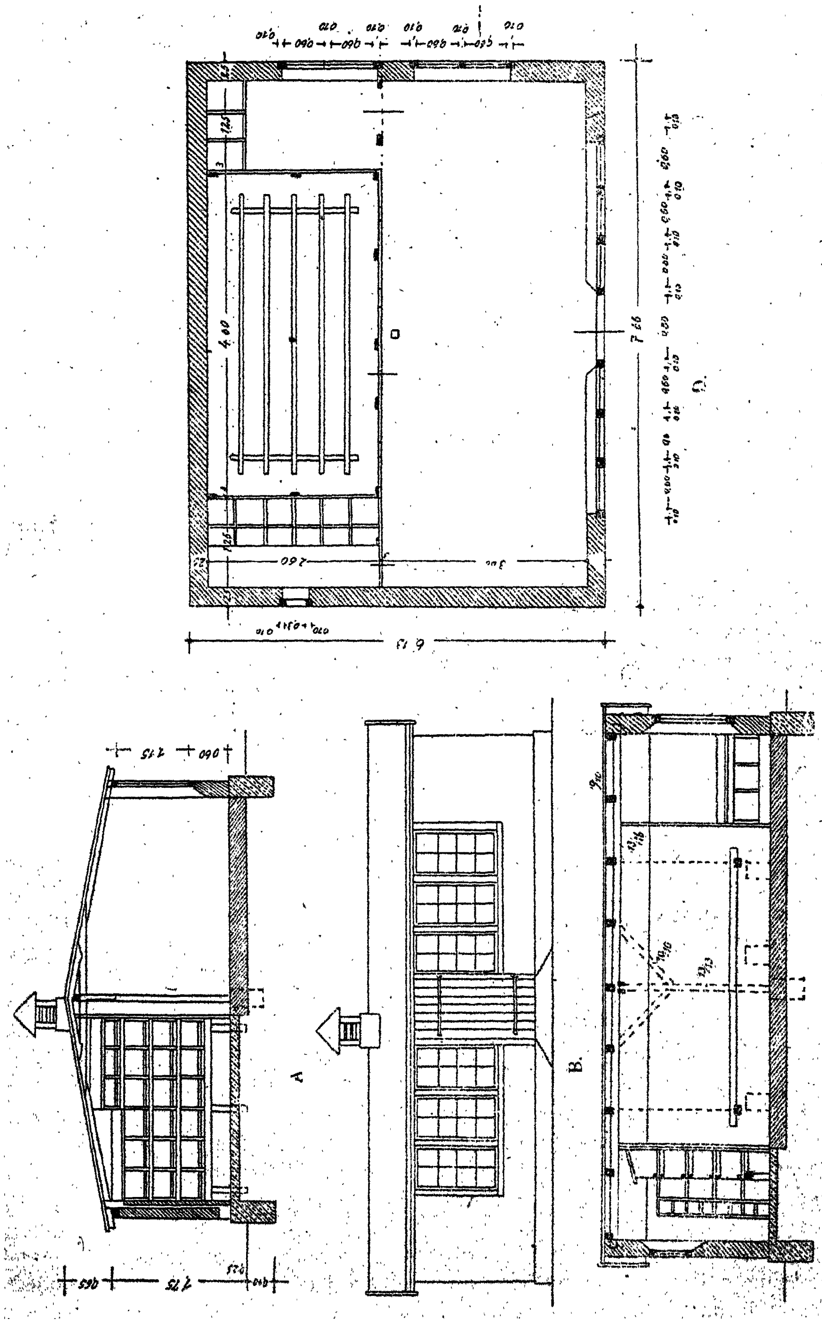
BUILDING CONSTRUCTION.

163 - **Fowl House for 80 or 100 Fowls.** — *Beilage zur Illustrierten Landwirtschaftlichen Zeitung*, Year 33, No. 98, pp. 220-221. Berlin, December 6, 1913.

The annexed figures show the details of a fowl house for a hundred head of small poultry or eighty of larger birds. This fowl house was designed by the Chamber of Agriculture of the Duchy of Oldenburg and cost between £ 28 and £ 36. The outer walls are of reinforced clay (1), and the roof of ruberoid.

The entrance is on the south side; it leads into the day-quarters of the poultry, which occupy moer than half of the total space of the building; the rest is taken up by a large roosting space and by two smaller rooms for the laying and sitting hens, containing also nests and brood boxes. The nests are placed in rows above each other and are easily reached by ladders. The brood boxes are on a level with the ground and adjoin a part of the floor set apart for the chickens. The average height of the building is about 6 feet.

(1) See No. 832, *B.* May 1912. (*Ed*).



Fowl house for 80 or 100 birds. — A, Cross section. B. South elevation. C, Long section. D, Plan.

RURAL ECONOMICS.

164 – **Farming on the Share System and Monograph of a Large Estate worked on this System during the period from 1891 to 1910.** — JENNY, E. *Staats- und Sozialwissenschaftliche Forschungen*, Part 171, pp. XVIII + 346 Munich and Leipzig, 1913.

The share system or metayage is a form of farming according to which the landowner provides the metayer with a certain extent of land for him to cultivate (under his direction and control) and receives in exchange a certain proportion of the gross produce. It differs from simple farming with payment of rent in kind, in that the quantity of produce in kind delivered by the cultivator of the land to the owner is not a fixed and absolute quantity, but a fraction of the gross produce, as it is produced by the land itself. On the other hand the metayer farmer must supply all the labour required from the beginning to the end of the cycle of production, for the payment of a part of the produce for some special work can not be called metayage. The writer distinguishes three kinds of metayage: 1) The whole farm metayage; 2) Plot metayage; 3) Labour metayage ("corvée" farming). These three varieties have in common the characteristic of metayage, namely the proportional division of the gross produce and consequently of the profits, as well as the risks and losses, between both parties; where they differ is in the greater or lesser completeness and independence of the farmer, in the demands upon the work and initiative of the owner, and in the share of working capital which each puts into the concern.

The share system of farming, which dates back to the most remote times (it was practised in Babylon, India, Egypt, Rome) is at present chiefly found in Italy, France, Russia, Rumania and in the South of the United States of America. The localities most favourable for this system are determined by social, climatic and economic conditions. It seems most suitable: 1) Where the contrasts in the distribution of landed property are more marked and where the lack of a prosperous class of peasants is more complete. 2) Where it is more difficult to secure sufficient good agricultural labour or where a number of very small landowners strongly attached to the locality and not possessing sufficient land for their wants, object to working for wages. 3) Where the products of the farm are mostly consumed in the farm itself. 4) Where on the one hand an extensive agriculture is carried on according to routine and on the other hand certain crops require intense, careful and minute work. 5) Where the inconstancy of the crops from one year to another is greatest.

The writer shows that the metayage contract cannot be considered a contract of partnership or a simple agreement for renting land or hiring labour, but must be recognized as a special form of contract, one *sui generis*.

The first fundamental function of the share system consists in determining and apportioning between the two parties the profits of landed capital and of labour according to what each contributed to production.

The lower the rent value of the land is in comparison to the price of the labour bestowed upon it by the metayer, the smaller will be the portion of the returns due to the proprietor and *vice versa.* The history of metayage shows that the share of the owner varies between one-tenth and one-half, while that of the metayer but rarely sinks below one-half. Of course such an arithmetical fraction does not express exactly the proportion between the ground rent and the value of the labour except in exceptional cases. But there is, moreover, the third factor of production, the working capital, the providing of which is a useful regulator for determining more exactly the relations between the two contracting parties, which are only roughly expressed by the proportional fraction.

In this respect the total or partial providing of live stock, machines and implements, and seeds is especially important in whole-farm metayage, while in plot and labour metayage any rise in the ground rent is compensated advantageously for both parties by a more intense cultivation. Under all circumstances, however, the fundamental principle of metayage must be maintained, namely that the produce is divided in proportion to the rent value and expenses of the owner on the one hand, and to the money value of the labour and expenses of the metayer on the other. Consequently any prestation or due of absolute amount, in money or in kind, as well as any labour not connected with the land under metayege, is to be avoided, for experience has shown that they lead to serious abuse, and to excessive burdens on the peasant, and alter the proportionality of the division of profits.

When it is a question of new expenses (improvements, introduction of new branches of farming, etc.), the division of the gross produce in proportion to the cooperation of the two parties is the only just basis of the settlement. This may be effected by one of the following methods: both parties contribute to the innovation in proportion to their portion of the profits, or by the side of the main accounts a new account is opened for the innovation, or again if the contribution of the two parties is much altered, then the ratio itself of the divisions of the produce may be changed.

Similarly. in the special agreements as to improvements lasting a long time, the distribution of the expenses must be adapted as completely as possible to the ratio of the metayage; with this object, the time estimate for the amortization must be determined as exactly as possible; then the metayer, being rewarded by his part of the profits, will willingly submit to a greater demand upon his labour and will work at the improvements more conscientiously than any hired labourer.

The size of the metayer farms varies very considerably in different countries; in general, however, it is such as to guarantee the living of a family and at the same time to utilize completely all their labour.

The legal duration of the metayer agreement is generally one year; in practice, however, the tacit renewal has converted it into a contract lasting a long time, which is really the most suitable for this form of farming, because metayage must, from its very nature, include a number of chances

of profit so as to attain a reasonably constant average. The second chief function of metayage, which forms the principal justification of its existence, consists in the diminution of the risks of production, thus being a kind of insurance of the producers. It is especially to be noted that each of the parties ensures for himself the most necessary and dearest and often otherwise unattainable factor of production, namely land for the labourer and labour for the landowner, while exposing to the risk of loss only that factor which for him is the cheapest (labour in the case of the labourer and ground rent for the landowner). This advantageous exchange of values, by diminishing the stakes, diminishes the absolute risk for both parties, and besides, by its compensating effect from year to year, is one of the best means for counteracting the effects of bad seasons, of crises due to falls in prices, of changes in labour and wage conditions and also, frequently, of political disturbances. Consequently the yield of agricultural products is much better ensured by the metayage system than by any other, and this both from the labourer's and the landowner's point of view, as well as from that of national economy.

The eminent economic and social effects of metayage are undoubted. By equalizing the yields, it affords a solid basis to agricultural production, which is often of a risky nature, and it mitigates or removes altogether the serious consequences of a defective distribution of landed property (such as the reduction of the rural population to the state of a proletariat of day labourers, the apparition of the middleman and of the usurer with their train of evils, and absenteeism) and helps a diligent population without capital to the possession of land and prosperity; it offers the most favourable solution to the rural labour question and is a stimulus to the harmonious cooperation of the various social classes for the attainment of common aims and ensures in this manner the most beneficial technical, ethical and political results.

History teaches us that metayage is an excellent system for attaching people strongly and rapidly to the soil in new countries. It should thus, according to the writer, prove a good system for home colonization.

In the last chapter of the first part of his work the writer gives as an introduction to the second part, which is a monograph on a large metayer estate in the district of Odessa, an exhaustive review of the metayer system in Russia. He shows that metayage had to extend greatly in that country in consequence of the juridical development of the conditions of land ownership there obtaining, and that it had to take the special character of plot and labour metayage. The peasants were bound to the land, but did not possess enough of it to supply their wants or to utilize economically all their labour, so that they were forced to rent some fields (need or hunger rents, Not- Nahrungs- Hungerpacht); this led to insupportable conditions of usury and oppression. Such a state of things could be improved only by a conscientiously and firmly applied metayage. In fact metayage has in many parts of Russia favourably prepared the way for the new organization of landownership which is being introduced. The writer

calculates that real metayage is practised in European Russia over an area of about 40 500 000 acres.

The estate described by the writer is situated in the South of Russia in the Odessa district, where a decidedly continental climate prevails. It is composed of four farms amounting altogether to 19 573 acres of extraordinarily fertile soil (black earth). Besides these natural conditions, the character of the people, in which a strong love of independence prevails, and their economical position (very small proprietors under the form of "Mir" or village-community) and the unfavourable labour conditions led the way to metayage. Out of the 13000 acres of arable land, about 1900 were rented, 1350 were cultivated by the owner himself and the rest, or 9750 acres, were farmed on the metayer system, which, during the twenty years, changed from plot metayage to labour metayage.

The writer gives the text of an agreement with a metayer. The most remarkable features are the sharp limits set to the obligation of labour (no demand being made beyond the quota of the metayage), and the stress laid upon punctuality and order. A minute description is given of the technique of the metayer farming: distribution of the land to the peasants and conclusion of the agreement, summons of the metayers to work, oversight and control.

During the years 1891 to 1898 the share of the owner was one-third. The cost of cultivating one acre was about 9s *7d*. The value of the rent of the land being between 4s *8d* and 5s *6d* per acre, the metayer received 2 acres of land to cultivate for himself for every acre of land he cultivated for the landowner.

From 1895 the rent of the land rose constantly; at first this increase was compensated by the improvement in the quality of the labour on the owner's fields. But when the rent value rose to 7s 10*d* and 8s *7d* per acre, the quota of two-fifths was gradually introduced into the whole estate. The metayer received three acres of land for his use as compensation for working two acres for the landowner.

Metayage is especially adapted to diminish the risk due to the enormous inconstancy of the crops in the South of Russia.

Table I (p. 260) gives an idea of the range of the crops of spring wheat, barley, rye and winter wheat during the years 1891-1910.

Further causes of risks are the great uncertainty as to the effective cost of production, owing to the unsatisfactory condition of wages, the untrustworthiness of hired labourers, especially at harvest time, and the great oscillations in the prices of cereals not only from one year to another, but also in the various seasons and even within the same month. The writer shows how all these risks are considerably diminished by the metayer system, both for the farmer and for the owner, if indeed they are not completely avoided, and he proves by schematic calculations that with metayage almost the same average results are obtained as by cultivating on one's own account, except that with the latter much greater deviations must be borne and thus a much higher risk than with metayer farming, owing to the much more considerable circulation of capital.

TABLE I.

Returns in lbs. per acre.

Year	Spring wheat	Barley	Rye	Winter wheat
1891	147	147	281	—
1892	401	468	535	—
1893	1364	1578	1271	2568
1894	743	1204	810	696
1895	703	1271	1284	1177
1896	77	140	160	—
1897	482	850	334	214
1898	703	1578	796	1217
1899	0	0	0	—
1900	187	294	120	0
1901	589	796	943	783
1902	0	147	281	1097
1903	575	769	736	682
1904	428	508	441	—
1905	401	468	—	—
1906	589	1084	1070	—
1907	482	769	214	174
1908	548	682	321	—
1909	415	743	535	441
1910	294	1084	943	1739
Average of the years 1891-1910	471.79	754.04	599.90	807.33

0 signifies that the crop was sown but not harvested.
— " that owing to the bad weather it could not be sown.

If 5*s* 1*d* per annum with metayage is accepted as the lowest limit of the net income per acre (to defray taxes, interest on mortgages, personal and general expenses) with which the owner can manage without having to put other money into the concern, then 14*s* 10½ *d* more per acre must be added for cultivation and harvest expenses if the owner farms on his own

TABLE II.

Year	Average yield per acre of wheat, barley and rye	Farming by the owner. Deviation of the yield from the minimum	Metayage: Yield per acre of total area	Metayage: Deviation of yield from the minimum	Advantages: of metayage	Advantages: of farming by owner
	£ s d	£ s d	s d	s d	s d	s d
1891	10 9½	— 9 2¼	4 3¾	— 9¼	8 4¾	—
1892	18 8¼	— 1 3½	7 5½	+ 2 4½	3 8	—
1893	2 0 4	+1 0 4¼	16 1½	+ 11 0½	—	9 3¾
1894	1 8 7¼	+ 8 7½	11 5¼	+ 6 4¼	—	2 3¼
1895	1 14 3½	+ 14 3¾	13 8½	+ 8 7½	—	5 8¼
1896	4 4¾	— 15 7	1 9¼	— 3 4	12 3	—
1897	1 3 5¼	+ 3 5½	9 4½	+ 4 3½	9¾	—
1898	1 18 1½	+ 18 1¼	15 3	+ 10 2	—	8 0
1899	0 0	— 19 11¾	0	— 5 1	14 10½	—
1900	8 1	— 11 10¾	3 2¾	— 1 10¼	10 0½	—
1901	1 10 0¾	+ 10 1¼	12 0½	+ 6 11¼	—	3 1¾
1902	5 0¼	— 14 11½	2 0	— 3 1	11 10½	—
1903	1 7 8¾	+ 7 9	11 1	+ 6 0	—	1 9
1904	17 9	— 2 2¾	7 0	+ 2 0	4 2¾	—
1905	17 7	— 2 4	7 0½	+ 1 11½	4 3½	—
1906	1 13 0¼	+ 13 0½	13 2½	+ 8 1¼	—	4 11¼
1907	1 4 11½	+ 5 0	9 11¾	+ 4 10¾	—	1¼
1908	1 9 0¾	+ 9 11	11 11½	+ 6 10½	—	3 0½
1909	1 9 9¾	+ 9 10	11 11¼	+ 6 10	—	3 0
1910	1 11 9½	+ 11 9¾	12 8½	+ 7 7½	—	4 2¼
					£3 10s 5½d	£2 5s 5¾d

account: 5*s* 1*d* + 14*s* 10 ½ d = 19*s* 11 ½*d*. Table II shows by how much, in the various years, the actual returns were above or below this minimum level, further by how much in the average of 20 years this minimum has been exceeded by the owner when farming on his own account, and when farming with metayage. Thus the returns of metayage in nine years exceeded

by £ 3 10s 5½ d those obtained by direct farming, while in eleven years they fell below them by £2 5s 5 3/4d. This is a difference in favour of metayage of £ 1 4s 11 3/4d in 20 years, or a yearly average of 1s 3d.

The profit and loss account of the estate shows for the twenty years a final profit of £ 27 957 11s 2d on 12 148 acres under metayage, while calculation on the basis of the available figures shows a final loss of £159 17s 10d for direct farming by the owner. Besides, the latter accounts show that in six years the yearly loss ranged between £ 21 145 and £ 27 468, while in no year did the loss under the metayage system exceeds £ 4546. The results of the comparison between metayage and the paying of rent in cash lead to similar results for the peasant. Though the net profit under the two systems works out nearly the same for the labourer, it must not be overlooked that metayage affords him the possibility of utilizing his labour at a rate that he could not otherwise realize, saving in quite exceptional cases. And even a small surplus of profit under the renting system is never a sufficient insurance against the dangers of the renting system under given conditions. With metayage both parties divide the profit and the eventual losses, while one insures the other to a certain extent, so that a final favourable result is certain for both.

165 - **Situation and Problems of Live Stock Breeding and Keeping in Modern Intensive Agriculture.** - MOMMSEN, CHRISTIAN. - *Arbeiten der Deutschen Gesellschaft für Züchtungskunde*, Part 17, pp. VI + 145 and 5 Maps. Hanover, 1913.

With the increasing intensity of farming, which has passed successively from simple grazing to improved rotations with constantly increasing use of chemical manures and of hoed crops, the estimation in which live stock keeping and breeding were held sank; it only began to rise again when the greater prosperity of the propulation caused an increase in the prices of animal products. The extent to which live stock is kept is to a certain extent dependent upon the conditions of the market and of prices, and this to a much greater degree for pigs and sheep than for horses and cattle, as the latter animals are often kept for purely farming considerations (teams, production of manure, utilization of by-products).

From a comparison between the statistical data on the numbers of live stock and the harvest results in Prussia and in the province of Saxony, it appears that the changes in the numbers are not explained by the results of the harvest in the corresponding year and that more probably there is very little connection between the two facts. It is not one abundant harvest alone, but a series of them, that leads to considerable increase in stock. There is no doubt that prices have a greater influence than harvests in this connection, and this is especially seen in the case of pigs, while since 1907 the increase in the numbers of cattle has stopped, in spite of the tendency of the prices of cattle to rise. Evidently other determining factors are here at work.

The extent to which stock is kept is in the main determined by the lowest harvests. In a certain sense here also the law of minima obtains. That such is the case, is also proved by the fact that live-stock keeping and breeding, not including sheep, is lowest in those parts of Saxony in which

the highest average harvests are obtained, where absolutely and relatively the greatest quantities of forage exist: in the districts with the most intensive agriculture, where sugar-beet growing is largely practised. Large estates are partly responsible for this evil. Another cause is the prevailing tendency to give too much prominence to the theory and practice of high class breeding, while at the present time it is the breeding of stock destined to satisfy the wants of the population that is required.

Further, stock breeding is neglected by farmers on account of the ever increasing demands of intensive agriculture; it thus becomes less and less profitable and people get accustomed to consider it *a priori* as an unprofitable branch of farming. The means to remedy this state of things are: a better education of farmers in stock breeding, the technical and social improvement of workers in this field, the increase of special employees for stock breeding so as to get a more scientific management of this branch of farming, and the demonstration of the organic connection between stock breeding and intensive farming.

In consequence of the increased intensity of farming, the production of fodder has increased also and especially such as can be sold only with difficulty or not at all, as is the case with the by-products of hoed crops. In order to utilize them they are fed unsystematically and in too large quantities to the small number of animals, thus not only wasting much food, which represents a loss, but also injuring the health of the animals (which the writer investigates and demonstrates) and in this manner still further diminishing the profits on the stock. In order to diminish the loss, the number of head kept is still further reduced, the feeding in its turn gets more unsuitable and the results are always worse. It is not realized that a vicious circle is here followed and that the conditions of these farmers are such as to require rather an increase of their live stock, obtained by breeding the animals themselves, and that only thus will they be able to utilize fully their masses of fodder. The writer gives some examples of feeds, with the calculation of their cost, for the systematic breeding of heifers, bulls and heavy draught horses.

He then shows that pasturing is necessary for rearing young animals and that also in the interior of the country profitable pastures may be laid down. The manurial conditions of the farm are improved by turning a portion of the arable land into pasture, and keeping young animals at pasture allows live stock to be kept during the winter. Without considering the invaluable advantages for the health of the animals obtained by grazing and which are of special importance for the beet farms, pasturing is in itself profitable when it is suitably managed. The writer gives some practical hints on grazing and warns against overstocking.

The profits of stock keeping depend less upon the breed of the animals kept, than upon the way of keeping them and the object aimed at. Especially in farms with intensive hoed crops, better results would be obtained if less prominence were give to the production of milk and if fattening were combined with rearing young animals on pastures. The keeping of horses also would turn out much cheaper if breeding were practised and the

work done by brood mares and young horses instead of with expensive purchased geldings.

The widely spread opinion that live stock keeping is *a priori* unprofitable is false ; it becomes so by the way in which it is managed in the present system of intensive farming. The valuation given in the accounts to the fodder and to the manure produced in the farm itself contributes also to cause stock keeping to appear unprofitable. According to the writer the only proper way of fixing the price of such fodders is by considering their practical feeding value, the crop returns and also their cost of production, and not one only of these factors to the exclusion of the others.

In no case, however, should live-stock keeping be debited with these fodders at a price which is only exceptionally paid for a small portion of them and which cannot be realized for unlimited quantities.

166 – **Intermediate Valuation of "not Marketable" Produce of the Farm in Agricultural Book-keeping.** – BUDE, ALBERT in *Archiv für exakte Wirtschaftsforschung*, 11 Complementary Part, pp. 101-164. Jena, 1913.

After some introductory remarks on the systems of book-keeping adopted in farms, and on the general theoretical and practical bases of valuation, the writer discusses the valuation of the forage produced in the farm itself and either not marketable or only so to a limited extent, in its connection with agricultural book-keeping. He proposes to replace the more general expression " money value " by "intermediate value" (Zwischenbewertung), because it should indicate the transitory value that this fodder possesses at its delivery from the fields to the productive stock and not its final food (or total agricultural) value.

The introduction of different intermediate values exerts no influence on the total net returns of the farm, but it can cause great differences to appear in the profitableness of the various branches of the farm ; what is required is to determine such intermediate values for these products as represent rightly the relation of the field crops and productive stock to each other and to the whole farm.

With the help of tables containing data taken from practical farming, the writer discusses the intermediate values of the above fodders from a physiological and economic point of view.

In drawing up an accurate estimate of the feeding requirements according to Kellner's rules, those commercial foods are chosen which with the least expense bring up the less concentrated foods of the farm itself to the normal ration required by the system of utilization that has been adopted. In so doing the value of the protein (according to Ehrenberg), which changes for every farm and from year to year, must be considered, and deduction must be made of the manurial value of the commercial foods.

Only those unmarketable products which are effectively consumed by the productive live stock are to be included in the intermediate valuation ; those that are sold directly on the market or those still on hand at the end of the year for sale or consumption in the farm itself must be excluded from the account.

In the feeding estimate, the price on the spot per lb. of starch-value in the mixture of commercial food necessary for systematic feeding (not only in the cheapest concentrated food) forms the basis of prices for the valuation of the unmarketable produce of the farm.

The starch-values contained in the foods of different concentration cannot be considered as equivalent, and have to be valued differently in such fodders produced in the farm. The measure of this lesser value of the less concentrated farm foods is given by the super-concentration of the purchased concentrateds, which are rendered necessary precisely by the lesser value of the former. By super-concentration is meant the excess of protein and starch-values contained in the purchased concentrateds over the average concentration of the rations fed by the farm. The food produced in the farm itself must thus pay the cost of this super-concentration; that is to say the price of these foods must be diminished by the amount of the expense caused by the purchase of the excess of concentration delivered at the farm.

The distribution of the value to be deducted among the various foods produced in the farm is then made according to the algebraic sum of the excess and deficiency of their content in protein and starch-value compared with that of the average total concentration required.

The greater yield due to the farm manure and expressed in money cannot be considered simply as the productive value or money value of the manure. The total amount of the cost with the total gross yield of the manured and unmanured land should be compared in order to determine the final value of the manure. But the account of the productive live stock must not be credited, nor the crop account debited, with anything but an intermediate value for the manure also.

The numerical calculation of the intermediate value can only be made on the basis of a comparative money valuation. Considering the exceedingly variable composition of farmyard manure, its intermediate value cannot be determined on its content of fertilizing substances; the effect of the factors determining its value must instead be taken as a basis and the effect produced by farmyard manure must be compared with the corresponding effect of artificials and the cost (= intermediate value) of farmyard manure be inferred from the cost of mineral fertilizers. This is obtained by the following equations:

I. The cost of mineral fertilizers which give the greatest returns (a) stands to the net returns produced by them (b) as the unknown intermediate value of the farmyard manure (x) is to the unknown relative net returns produced by the latter (y), or:

$$a : b = x : y.$$

II. Money value (intermediate value) of the manure (x) + net return produced by it (y) = Value of farmyard manure (c), or:

$$x + y = c.$$

In this method of valuation all the principal factors which exert a decisive influence on the money value of farmyard manure are considered:

1. Influence of the soil's need of farmyard manure; 2. Increase of yield due to manure; 3. Comparison of the effect of farmyard manure with that of chemical fertilizers; 4. Influence of the economic situation. It follows, however, that this intermediate valuation can only be made exactly for one given farm and on the basis of manuring experiments made in that particular farm. If the first two factors determining the value of farmyard manure be called physiological factors, the two latter form the economic factors. This method of intermediate valuation is thus also founded on a physiological and economic basis.

In order to carry out the practical valuation of farmyard manure, the writer used as a basis two field experiments on light and heavy soils taken from the work of B. SCHULTZ of Breslau " Effect and money value of farmyard manure according to eight field experiments each lasting four years ", and he collects in several tables the average results of this calculation and probable oscillations.

167 - **Cause of Difference of Income in Two Pure-bred Dairy Cattle Farms.** — OTIS, D. H. in *Hoard's Dairyman*, Vol. XLVI, No. 12, pp. 319 and 329-530. Fort Atkinson, Wisconsin, October 17, 1913.

The writer compares carefully with the aid of tables two dairy cattle farms situated in favourable positions as to means of communication. They are respectively 400 and 160 acres in extent and the smaller of the two yields a managerial income $3 380.62 higher than that of the other.

The following table shows the principal data of the inner economy of the two farms:

	Farm I	Farm II
Total area	400 acres	160 acres
Arable land	101 »	103 »
Total capital	$ 56 289.50	$ 49 190.10
Fixed capital (amount und percentage of total)	$ 41 600	$ 22 800
	73.9%	46.4%
Working capital (amount and percentage of total)	$ 14 689	$ 26 390
	26.1%	53.6%
Investment in cattle	$ 4 990	$ 21 550
Number of head	61	67
Total receipts	$ 8 750.90	$ 13 811.74
Live stock products sold	$ 3 030.00	$ 3 337.99
Live stock sold and increased inventory of live stock	$ 3 476.50	$ 7 390.25
Sale and increased inventory per cattle unit	$ 18.22	$ 126.08
Total running expenses	$ 4 234.77	$ 4 196.90
Expenses for labour	$ 2 270.40	$ 1 639.60
Printing and advertising	$ 11.00	$ 245.00
Interest, 5%, on capital	$ 2 814.47	$ 2 459.50
Total expenses	$ 7 899.24	$ 9 579.46
Net results (managerial income)	$ 851.66	$ 4 232.28

The extent of arable land is very nearly equal in the two farms, while the running expenses are nearly the same.

The total expenses are even greater by \$1680.22 on the smaller than on the larger farm. Consequently the great difference in the net results can only be caused by the difference in the receipts; it comes chiefly from the sale of cattle and from the difference in the increase of inventory. The writer is of opinion that the higher managerial income of the smaller farm is almost entirely due to more judicious breeding, selecting, testing and advertizing.

168 - **Sugar-Beet Farming in Austria-Hungary.** - SEDLMAYR, E. C. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien,* Vol. II, Part 2, pp. 245-305. Vienna, November 29, 1913.

The writer describes the conditions of farming (exclusive of the conditions of capital and profitableness) of ten large farms which grow sugar-beets in Austria-Hungary. In only one case was the extent of the farm below 500 acres and in two cases it was above 2500. The data given are the result of an enquiry and they embrace: conditions of climate and soil, means of communication, labour and wages; size of property and extent of the various crops; farming proper, rotation, manuring, tillage, yield of crops; live stock: draught animals (cost of a day's work of a horse and of an ox), productive animals (milking, fattening and breeding); dead stock; book-keeping; accessory industries.

169 — **Cost of Rearing a Calf.** — CLAUSEN in *Landwirtschaftliches Wochenblatt für Schleswig-Holstein,* Year 63, No. 44, pp. 883-884. Kiel, October 31, 1913.

The writer gives a summary of the cost of rearing a calf on the basis of the quantities of food administered and corresponding in nutritive content to Kellner's rules for feeding. The cost of attendance, rent of stable, insurance, and interest of working capital on the one hand, and the value of the manure on the other hand, are not included in the account. The whole milk is valued at 6.41 *d* per gal., and the skimmed milk at 1.6*d* per gal. Concentrated foods and hay are taken at the market price.

The weekly costs of food rise at first on account of the increasing quantity of whole milk given. In the fifth week a part of the whole milk is replaced by skimmed milk, in the seventh week whole milk is completely stopped, and in its place meal, crushed linseed and oats are fed.

The cost of rearing a six-months-old calf amounts to £6 14*s* 3*d* inclusive of initial cost. With a live-weight of 385 lbs., the cost per cwt. works out to £1 19*s*.

	Cost of food	Initial value and cost of food		Cost of food	Initial value and cost of food
	£ s d	£ s d		£ s d	£ s d
At birth	—	1 19 2½	14 weeks		4 15 7¼
1 week	4 1½	2 3 4	15 »		4 18 7½
2 weeks	5 5¾	2 8 9¾	16 »	together 18 1¼	5 1 7¾
3 »	6 2	2 14 11¾	17 »		5 4 8
4 »	7 3¾	3 2 3½	18 »		5 7 8¼
5 »	5 10	3 8 1½	19 »		5 10 8¾
6 »	4 3	3 12 4½	20 »		5 14 0¾
7 »	2 8¼	3 15 0¾	21 »		5 17 5
8 »	2 9¾	3 17 10½	22 »		6 0 9½
9 »		4 0 9½	23 »	together 1 3 6¼	6 4 1¾
10 »		4 3 9	24 »		6 7 6
11 »	together 14 9	4 6 8¾	25 »		6 10 10½
12 »		4 9 8	26 »		6 14 3
13 »		4 12 7½			

170 – **Observations on the Practice and Profitableness of Bee-keeping in Switzerland in 1912.** – Report of the Swiss Peasants' Secretariat, in *Schweizerische Bienenzeitung*, Year XXXVI, No. 12, pp. 459-466. Aarau, December 1913.

This paper is based upon the accurate book-keeping of twenty-five Swiss bee-keepers with an average of 25.5 hives each. The total capital invested in each undertaking is £99 3*s* 6*d*, or £3 17*s* 10*d* per hive. The average expenditure of time per undertaking is 149 hours, or 5h. 50 m. per hive. The gross returns in cash are made up as follows:

	Per bee-keeper	Per hive	Percentage
	£ s d	£ s d	—
Honey	14 3 4	11 2	72.65
Swarms	4 4 2	3 3	21.45
Comb, etc.	1 3 0	11	5.90
Total	19 10 6	15 4	100.00

The expenses and cost of production are the following :

	Per bee-keeper £ s d	Per hive £ s d	Percentage —
Sugar	6 3 10	4 10½	28.96
Small implements . .	13 6	6	3.15
Expense for hives . .	19 10	9	4.55
» for bee houses	18 3	8½	4.18
Sundries	1 14 11	1 4½	8.23
Work of bee-keeper . .	5 18 3	4 8	27.64
Total outlay . . .	16 8 7	12 10½	76.71
5% interest on capital	4 19 2	3 11	23.29
Total cost of production	21 7 9	16 9½	100.00

If the returns for swarms, comb, etc., are deducted from the general cost of production, the remainder is the cost of production of the honey. It amounts to £16 0*s* 7*d* per bee-keeper, or 12*s* 7*d* per hive ; with an average production of 312 lbs. of honey, this makes 1*s* 0 ¼*d* per lb.

With an outlay of £16 8*s* 7*d* and gross returns amounting to £19 10*s* 6*d*, the net returns are £3 1*s* 11*d* per keeper, or 2*s* 5*d* per hive, which is equal to 3.1 per cent. on the capital invested. The average income of the beekeeper is thus (labour plus net returns) £9 0*s* 2*d* per keeper or 7*s* 0 ³/₄*d* per hive.

171 – **Foundation of a Land Valuation Office by the Swiss Peasants' Association.** — *Schweizerische Landwirtschaftliche Zeitschrift*, Year XLI, Part 52, p. 1247. Zürich, December 24, 1913.

The Swiss Peasants' Association founded a land valuation office on January 1 of this year at Brugg, with the following programme :

1. Preparing valuations for private persons, for credit institutions and for the State.

2. Assisting in carrying out official valuation : *a*) by preparing opinions on the average values in the various localities, by grouping the soils into classes, by drawing up score cards for individual valuations and undertaking the latter; *b*) by conducting courses on the subject.

3. Carrying out scientific work in agricultural appraisement under the direction of the president of the Swiss Peasants' Secretariat and in connection with the section for the research on profitableness, as, for instance: *a*) preparing the basis for real estate valuation in Switzerland ; *b*) drawing up tables to facilitate the appraisement of land ; *c*) preparing and collecting the systems of valuation of special groups of agricultural capitals (fruit trees, forest trees, vineyards, dead stock, improvements, buildings and the like); *d*) critical elaboration of official regulations on appraising; *e*) discussion of recent publications in land valuation literature.

172 – **Institution of an Agricultural Book-keeping Office at the German Section of the Council of Agriculture for the Kingdom of Bohemia.** — *Land- und Forstwirtschaftliche Mitteilungen*, Year 15, No. 23, p. 257. Prague, December 1, 1913.

According to the resolution of October 25, 1913, a division for agricultural book-keeping and farming advisorship was instituted at the German Section of the Council of Agriculture for the Kingdom of Bohemia; this will soon commence work.

173 – **Association for Obtaining Probatory Power for Agricultural Book-keeping and for Furthering the Science of Farm Management.** (1) BURG. — Report of the Transactions of the First Meetiug on February 18, 1913. Part 1, pp. 26. — (2). HOWARD. — Report upon the Origin and Development of our Endeavours up to the Present. Part 2, pp. 18. Berlin, 1913.

The above Association, wihch commenced its existence with the meeting of February 18, 1913, in Berlin, proposes:

1. To secure for the book-keeping of farmers the same probatory power as that already recognized by law as being possessed by the books of other professions.

2. To afford the followers of the various systems of book-keeping a place in which to express their views and to come to mutual understanding.

3. To promote the study of the science of farm management.

4. To awaken in the members of other professions a better understanding of the conditions of existence of farming, and thus to diminish the existing conflict of interests between town and country.

The Association has its seat in Berlin and holds yearly one ordinary general meeting. The two publications hitherto issued by the Association contain precise data on the preliminaries and the circumstances of its foundation, the means to be used for the attainment of its objects and its statutes.

AGRICULTURAL INDUSTRIES.

DAIRYING.

174 – **Influence of Pasteurizing on the Fat Globules of Cream. Preliminary Research.** – HAGLUND E. in *Nordisk Mijeritidning*, p. 485. 1913.

According to the researches of M. Barthel (*Milch Zeitung*, 1904, p. 400) the well-known fact that separating becomes less complete after preliminary pasteurization depends upon the fact that the fat globules get broken by the rapid movement of the milk during pasteurization. It is therefore essential for the economy of the dairy not to allow the agitator to work more than is strictly necessary. Similarly the widespread opinion that pasteurized cream gives a buttermilk richer in fat than that yielded by non-pasteurized cream leads to the belief that pasteurization has the same effect on cream as on milk, but on the other hand the tendency of the butter globules to agglomerate at a high temperature renders a contrary effect of pasteurization possible.

The writer, chief of the dairy section of the Central Agricultural Experiment Institute in Sweden, submitted this problem to a preliminary investigation, which yielded the following result:

Employing Gutzeit's method (1) it has been demonstrated that pasteurization caused a decrease in the number of the fat globules, on an average from 2300 to 1689 per 1 μ^3 of cream; that is to say a certain number of globules had agglomerated to form larger globules. The average volume had increased from 12.95 to 18.93 μ^3, and a classification of the globules according to their size showed that the number of globules of 2.5 μ^3 had kept the same, whilst the number of those of at least 5 μ^3 had increased from 7 to 11 per cent. A comparative examination between cream that had been heated only and cream that had been heated and stirred at the same time, showed that heating alone does not cause the running together of the globules, but that this is facilitated by mechanical agitation.

175 - **Bacterial and Enzymic Changes in Milk and Cream at 0°C.** — PENNINGTON, M. E. and COLLABORATORS. (Food Research Laboratory, U. S. Dep. of Agr. Washington) in *The Journal of Biological Chemistry*, Vol. XVI, No. 3, pp. 331-368. Baltimore, December 1913.

In a previous paper (2) the writers have shown that milk stored at 0°C, undergoes market proteolysis, and the present investigations were undertaken to determine how far the changes were brought about by bacterial action and how far they were due to enzymes.

Commercial milk and cream were obtained from a dairy certifying to a high grade of purity and four sets of samples were prepared as follows :

1. Sterilized for 30 minutes in an Arnold steam sterilizer on three consecutive days, and then reinfected with organisms precipitated from the raw milk, thus limiting the changes to those brought about by bacterial action alone.
2. Received 0.1 per cent. of formaldehyde to limit the changes to those brought about by enzyme action alone.
3. "Raw" or untreated milk, where both the above factors were working in combination.
4. Sterilized, but not reinfected, to serve as a control.

After treatment the milk and cream were maintained for 35 days at constant temperature (0° C.) in a mechanically refrigerated room, and at intervals of a week the different sets were sampled and subjected to chemical, bacteriological, and zymochemical analyses.

The proteolysis of casein, the fermentation of lactose, and the hydrolysis of fats proved to be due to the action of bacteria, while the proteolysis of albumen was the result of enzyme action. The two varieties of oxidase, the two varieties of reductase and the catalase retained their activity in spite of the prolonged exposure to a temperature of 0° C. The guiac oxidase and the aldehyde reductase in milk appeared to be derived from bacteria only, while the other enzymes were probably partly due to the bacteria and partly native to the milk or the cream itself.

(1) *Landw. Jahrbuch der Schweiz*, 1895, p. 539. (*Authors note*).
(2) *The Journal of Biological Chemistry*, Vol. IV, p. 353, 1908.

The bacterial content of the raw and reinfected samples was estimated by plating out and incubating the plates at 37°, 20° and 0°C; the plates incubated at 20° and 0° C. gave larger counts than those incubated at 37° C. Milk after 35 days contained over 300 million bacteria per cc., and cream after 21 days contained 120 million bacteria per cc. Almost invariably *Micrococcus aurantiacus* (Cohn), and *Micrococcus ovalis* (Escherich), which belong to the group of acid-formers, were the predominant organisms of both "raw" and reinfected sterilized milk and cream.

176 - **A New Butyrometer for Determining the Amount of Fat in Cheese.** — NILGES, H. in *Molkerei Zeitung*, Year 27, No. 86, pp. 1665-1666. Hildesheim, November 5, 1913.

This butyrometer, constructed by Dr. A. Hess and put on the market by Wilhelm Vick of Rostock, Germany, consists of a butyrometer having one end open and the other closed, and reduced in the middle to a flat tube which bears the scale. The upper and lower parts contain each 25 cc. and each division of the scale corresponds to 1 per cent. of fat. Half percentages can also easily be read.

The instrument is used as follows: 5 grams of finely grated cheese are put into it and then 10 cc. of sulphuric acid of S. G. 1.41. The lower part of the butyrometer is plunged into boiling water and gently shaken until its contents are dissolved and the liquid has become a uniform mass of a brownish violet colour. Undissolved particles are easily recognised, for they float as yellow dots on the surface of the liquid. When all the cheese is dissolved, which takes place after 8 to 10 minutes, a further 10 cc. of sulphuric acid is added, this time however of S. G. 1.82. The instrument is then cloesd, well shaken and centrifugated for 5 minutes with the closed end towards the axis of the machine. The liquid thus passes from the larger lower space into the upper one and fills a portion of the graduated tube, so that the position of the column of fat that has separated out can be easily regulated by the stopper. The instrument is left for a short time in a water bath at 65 to 70° C. (149 to 158° F.) and then the amount of fat is read off on the scale after having previously set the sharply defined division between the fat and the rest of the liquid against the O of the scale by drawing out or pushing in the stopper; the bottom limit of the meniscus is to be taken.

In using the instrument, attention must be paid to its perfect dryness and to the fine division of the cheese. Soft cheeses can be introduced into the upper part of the butyrometer by a spatula, the acid added, the instrument closed, turned round and the casein dissolved in the upper part; then the second addition of the acid is made and the rest of the test carried out as with the hard cheeses.

The writer made comparative determinations with 12 different cheeses at the Dairy Institute at Güstrow. They showed that the results of this new instrument agree well with those of the analytical method, while Dr. Wendler's new "Sal" method often gives too low values. The differences between this new method and the analytical method ranged from — 0.21 to + 0.45 per cent.

The writer considers this new method as the simplest and most exact hitherto known and very suitable when many determinations have to be made.

177 – **Faulty Milk in Cheese-making: its Detection and Prevalence.** — STEVENSON, W. (West of Scotland College of Agriculture) in *The Journal of the Board of Agriculture*, Vol. XX, No. 9, pp. 772-773. London, December 1913.

In 1912 the cheeses from a well-known farm in Ayrshire, which has a high reputation for the quality of its Cheddar cheese, developed an unpleasant flavour in the later stages of ripening. The cause of this deterioration was investigated by incubating the milk from each cow, separately, at 98° F., for 24 hours. At the end of that time, a firm, close curd free from bubbles and with a pleasant flavour was taken to indicate that the milk was pure, while partial or total dissolving of the curd and the presence of gas showed that the milk had been contaminated either by dung or by inflammatory organisms from the cows' udders. The results of the tests showed that only 66 per cent. of the samples were irreproachable, and other herds similarly tested gave an even lower percentage. In order to use the unsound milk as economically as possible, it was pasteurised at 160° F. before being added to the bulk and by this means cheeses of excellent quality were obtained.

178 – **A New Method of obtaining Milk Serum and its Importance in the Detection of Watered Milk.** — SANFELICI, RICCIARDO in *Rivista Scientifica del latte*, Year 3, Part 5, pp. 65-67. Reggio-Emilia, October 1913.

This method is carried out in the following manner: 6 cc. of pure 50 per cent. tartaric acid are added (without warming) to 300 cc. of milk; the whole is well mixed, and left standing for 2 minutes until coagulation is complete. The mixture is filtered through a corrugated filter into a measuring cylinder and poured through again until the filtrate comes through clear.

In order to discover whether the milk has been watered, the specific gravity of 60 cc. of the clear filtrate at 15° C. is determined by means of a small Quevenne lactometer (1). If the temperature of the serum is above or below 15° C. the lactometer reading must be corrected as shown in the accompanying table. (The degrees of the lactometer correspond to the thousandths of the excess the S. G. over 1 : thus 29.2° = S. G. 1.0292).

(1) To be obtained from I. Greiner of Munich. (*Ed.*).

Temperature of the serum	Amount to be subtracted from the figure found	Temperature of the serum	Amount to be added to the figure found
deg. C.		deg.C.	
0	1.0	16	0.1
1	1.0	17	0.2
2	1.0	18	0.3
3	1.0	19	0.4
4	0.9	20	0.5
5	0.9	21	0.7
6	0.9	22	0.9
7	0.8	23	1.1
8	0.7	24	1.3
9	0.6	25	1.5
10	0.5	26	1.7
11	0.4	27	1.9
12	0.3	28	2.1
13	0.2	29	2.4
14	0.1	30	2.7
15	0.0		

The specific gravity of the serum of milks from the district of Lodi (Italy), varies only between 1.028 and 1.030, and thus allows the detection of very small amounts of added water.

Out of 100 milks to which the writer added 5 per cent. of water, 90 were detected by this method, while determination of the solids-not-fat and S. G. of the whole milk (in comparison with the minima of the district) gave only 50 and 8 detections respectively.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

179 - **The Importation of Cotton Seed into Algeria.** — *Bulletin Agricole de l'Algérie et de la Tunisie*, Year 19, No. 18, pp. 374-376. Algiers, 1913.

In order to complete the decree of the President of the French Republic dated September 2, 1912, fixing the conditions concerning the importation of cotton seed into Algeria, the Governor General of Algeria has ordered under date of Ang. 12, 1913, as follows:

Art. 1. — Cotton seed of whatever source may be imported into Algeria only through the ports of Algiers, Oran and Bône and the post of Ghardimaou.

Such seeds shall be disinfected on their arrival in the colony by the officials of the Phylloxera Service.

Art. 2. — This order shall be carried into effect by the Prefects of Algeria, the Customs Service and the Phylloxera Service, according as each is severally concerned.

BACTERIAL AND FUNGOID DISEASES.

MEANS OF PREVENTION AND CONTROL

180 - **Chemical Means for the Control of Parasites of Farm Crops.** — MOLZ, E. in *Fühling's Landwirtschaftliche Zeitung*, Year 62, Part 23, pp. 822-838. Stuttgart, December 1, 1913.

A list of the chemical means, known at present, for the control of animal and vegetable parasites of farm crops. The list comprises remedies based on the following substances: copper, sulphur, arsenic, formalin, carbolineum, soap, nicotine, fumigation with prussic acid.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

181 - **A Disease of Red Clover.** — BACCARINI, P. in *Bullettino della Società Botanica Italiana*, 1913, October-November, No. 7-8, pp. 118-121. Florence, 1913.

Of recent years the crops of red clover (*Trifolium pratense*) in the Val d'Elsa (Tuscany) have been subject to a very serious disease, with the result that many farmers have ceased to grow it. The disease threatens to become more serious owing to its rapid spread beyond its original limits. It

is known amongst the farmers as "incappucciamento", and is characterised by an excessive tufty growth and almost entire absence of flowering shoots. With repeated mowing, the disease becomes worse, so that in the second year the still vigorous plants take the form of thick tufts or low cushions of dwarf shoots yellowish green in colour; the new shoots lack vigour and become weaker and die; they are followed by even more delicate growth, until finally all signs of vilality disappear. The tap-root and side roots with their bacterial nodules appear quite normal.

According to this preliminary report given by the writer, the appearance of the disease, its development and the continual spreading to new areas indicate its infectious nature. Various fungi and insects have been found in the clover, but none of these can be looked upon as a specific cause of the disease. Further, several bacteria have been isolated from the diseased plants, of which one has proved to be pathogenic. Infection experiments with this particular organism have given positive results, but it is still necessary to confirm them and to work out the conditions of infection in the field, and the part played by the insects.

182 - **Wart Disease of Potatoes: *Chrysophlyctis endobiotica (Synchytrium endobioticum)*** (1).. — *Communicated by Prof.* JAKOB ERIKSSON, *Chief of the Phytopathological Section of the Central Agricultural Experiment Institute of Sweden.*

Since the appearance of the potato disease, *Phytophthora infestans* (Mont).de By., in Europe, no new affection of this plant has equalled in gravity the wart disease, caused, as is well known, by *Chrysophlyctis endobiotica* (*Synchytrium endobioticum, S. Solani*).

In England wart disease has been the object of extensive investigations and research since 1909. Scientific research has been carried out in order to discover the nature and the conditions of life of the fungus. Practical experiments have been conducted under the direction of the Board of Agriculture. Every year inspectors have been sent into the infected or suspected districts in order to determine the extent of the infection as well as its intensity in the various localities. In several places experiment fields have been instituted with the o ject of ascertaining how far dusting with fungicide powders or mixing them with the soil reduced or prevented the disease, and whether the different varieties of potatoes were all equally affected by the disease.

The researches and experiments made have demonstrated that the disease spreads slowly but steadily; the contagious matter preserves its virulence in the soil for years, and all the fungicides hitherto tried have proved ineffectual to prevent or diminish the mischief.

By the side of these negative results, it has however been observed that the different varieties of potatoes are very unequally affected by the disease. According to their resistance they may be classed as follows:

(1) See on this subject *B.* Dec. 1910, p. 361; No. 610, *B.* Feb. 1911; No. 1007, *B.* March 1911; No. 1911, *B.* June 1911; No. 3280, *B.* Nov-Dec. 1911; Nos. 219, 221 and 241, *B.* Jan. 1912; No. 425, *B.* Feb. 1912; No. 976, *B.* June 1912; No. 1100, *B.* July 1912; No. 182, *B* Feb. 1913; No. 751, *B.* June 1913; *B.* July 1913, p. 1006. (*Ed.*)

a) Varieties that are completely or practically immune from the disease: Langworthy, What's Wanted, Golden Wonder, Peacemaker, Sutton's Discovery (St. Malo Kidney).

b) Varieties generally immune from the disease, but liable to it if grown in infected soil: Aberlady Early, Milecross Early, Snowdrop, Southern Queen, Southern Star, Findley's Conquest, Sutton's Abundance, Sutton's Supreme, Sutton's White City, Chiswick Favourite, Dobbie's Favourite, The Crofter, The Provost, Davie's Laird and Schoolmaster.

c) Varieties seriously attacked in infected soil: Puritan, Sharpe's Victor, Express, Epicure, Myatt's Ashleaf, May Queen, Midlothian Early, Ninetyfold, Maryland Queen, Royal Kidney, British Queen, Radium, Russet Queen, Colleen, Lady Llewellyn, Sutton's Harbinger, Sutton's Centenary, Sutton's Satisfaction, Windsor Castle, Northern Star, Eldorado, Talisman, President, Tyne Kidney, The Scot, The Bruce, King Edward VII, Up-to-date and similar varieties such as Factor, Table Talk and Duchess of Cornwall.

Among the early potatoes the following are recommended: Snowdrop, Conquest and Abundance. The two latter yield an abundant product and are of good quality, but in rainy years they are very liable to *Phytophthora* and to leaf-curl, which render spraying with Bordeaux mixture indispensable. Among the late varieties the following are recommended: The Provost, Davie's Laird, Golden Wonder and Langworthy. If the soil is much infected the two latter are to be preferred.

It must be remarked that this classification is based only on experiments made in England. Our knowledge of several other diseases of plants has taught us that for a given plant resistance to a certain destructive fungus is not always the same, but that it can vary in different countries and according to the latitutes under which it is grown.

In order to determine to what extent the 1 per cent. formalin solution employed in Sweden against black scab (which appeared in the country for the first time in October 1912) (1) was capable of destroying the parasite in the soil, the Experiment Station carried out some special experiments in the summer of 1913 on three small plots, one 1 sq. metre (a little over 1 sq. yd.) and the other two 0.3 sq. m. (3 sq. ft.) in extent. These plots were isolated from the adjoining ground by a cement or zinc partition descending into the soil to a depth of over 3 ft. At the beginning of spring a great number of seriously diseased potatoes were mixed with the soil of the three plots. Somewhat later, about a fortnight before planting, the two small plots were watered with a 1 per cent. formalin solution at the rate of 10 litres per sq. metre (1.8 gals. per sq. yard), whil t the large plot was left unwatered. On May 20 the three plots were planted to potatoes; in one of the small plots two tubers of Magnum Bonum were placed, and in the other two of Up-to-date. This latter variety is recognized in England as being very liable to the disease. In the third and larger plot five tubers of Up-to-date were planted. In the three plots the plants grew vigorously

(1) See *B.* July 1913, p. 1005. (*Ed.*).

during the summer and autumn, presenting the appearance of healthy plants. On September 8 the potatoes were lifted. It was then found that all the tubers gathered from the plots that had been watered with formalin solution, namely 17 tubers of Up-to-date and 13 of Magnum Bonum, were completely free from black scab, whilst out of the 43 tubers lifted from the larger untreated plot, 39 showed characteristic eruptions of the disease. The infection however was not very severe on any of the five plants, owing no doubt to the fact that the contagious matter, having been introduced into the soil only in the spring and not in the preceding autumn, had barely penetrated into the soil.

Anyhow, the above experiment shows that a 1 per cent. formalin solution at the rate of 1.8 gals per sq. yard has the power of destroying the infectious matter in a soil infected by the potato black scab fungus. In dealing with a soil that has been infected for years a stronger solution will be necessary, namely 2 or 3 per cent.

183 - **American Gooseberry Mildew *(Sphaerotheca mors-uvae)* recorded from France.** — FOEX, ETIENNE in *Journal d'Agriculture pratique*, 1913, Vol. II, No. 49, pp. 717-719. Paris, December 4, 1913: and in *La Revue de Phytopathologie appliquée*, Vol. I, No. 13, pp. 165-167. Paris, December 5, 1913.

The writer records a small outbreak of American gooseberry mildew in the centre of France. He indicates the present distribution of the disease in northern and central Europe and the regulations adopted by some of the countries concerned (1) together with the methods of control at present in use (2).

184 - **The Effect on Carrots and Spinach of being grown in Soil infected by Finger-and-Toe.** — FRON, G. in *Journal d'agriculture pratique*, 1913, Vol. II, No. 49, pp. 730-731. Paris, December 4, 1913.

Several plots of cabbages were partly destroyed in 1912 by *Plasmodiophora Brassicae*. The cabbages were succeeded by a crop of carrots, which only flourished in the parts free from disease. The same effect was noticed in the case of spinach grown under similar conditions. The roots of the carrots were not examined, and no obvious disease was noticed on those of the spinach. They showed, however, certain deformities the cause of which has not yet been determined. Microscopic examination did not reveal the existence of the finger-and-toe fungus in the tissues.

(1) An editorial note in the *Revue de Phytopathologie appliquée* states that in France, where the disease was noticed and studied for the first time in June 1913, the Minister of Agriculture, on the advice of the "Comité consultatif des Epiphyties" has requested the Prefect of the Department of Loiret to issue immediately, by means of a provisional decree, such regulations as may be considered necessary for limiting as far as possible the damage due to the disease.

(2) See No. 1301, *B.* Nov. 1913. [*Ed.*].

185 – **Streak Disease of Sweet Peas.** (1) — *The Gardener's Chronicle*, Vol. LIV, No. 1409, p. 459. London, December 27, 1913.

The National Sweet Pea Society offers a prize of £ 10 10*s* and the Gold Medal of the Society to the first person furnishing a cure for streak disease of sweet peas. Communications should be addressed to the Secretary, D. Tigwell, Greenford, Middlesex.

186 – ***Ascochyta Gerberae* n. sp., Parasite of *Gerbera Jamesoni*, an Ornamental Composite.** — MAFFEI, LUIGI in *Rivista di Patologia Vegetale*, Year VI, No. 9, 3 pp. Pavia, 1913.

For the last two years the specimens of *Gerbera Jamesoni* possessed by the Botanic Garden at Pavia, and obtained partly from Antibes, have had their leaves damaged by a Spheroidaceous fungus which has spread considerably in 1913. The disease appears as a small nut-coloured circular spot, which gradually increases to some centimetres in diameter. And as on the same leaf several such spots are produced, these run together and almost completely spoil the leaf, which wilts. The spots become dark chestnut in colour and are either sharply defined or their edges shade off into a wine colour; they occupy both sides of the leaf and present concentric streaks. Observing them with a magnifying glass they appear dotted with small prominent bodies, the pycnidia of the fungus, which the writer refers to the genus *Ascochyta* and considers as a new species under the name of *A. Gerberae*.

The writer does not know whether the disease has developed in other localities; anyhow, considering the rapidity with which it spreads, it is advisable, failing practical means of cure, to collect and destroy the leaves that are attacked in order to prevent the spread of the disease on a plant which, though of recent introduction, is already, owing to its flowers, the object of considerable exportation and a not indifferent source of profit to those districts which grow it on a large scale. In Italy also its cultivation has been undertaken, especially in Liguria, where it thrives very well in the open and acquires its full beauty.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

187 – **A Poisonous Buttercup *(Ranunculus sceleratus* L.) in New South Wales.** — HAMILTON, A. A. in *The Agricultural Gazette of New South Wales*, Vol. 24, Part. 10, p. 862. Sydney, 1913.

Ranunculus sceleratus, described as especially poisonous to cattle, has been found by the writer at Waterloo, N. S. W., in a ditch flowing into Cook's River. It is probably a recent introduction and is not yet very widely spread. There is every prospect, however, of its spreading over a comparatively large area of low-lying marshy land in the neighbourhood of Cook's River, as the plant is a freely-seeding annual and occurs under conditions excep-

(1) See No. 1108, *B.* Sept. 1913. (*Ed.*)

tionally favourable for its propagation. These marshes are much used by local dairymen and horse owners for grazing purposes, especially during the summer months when other pastures are suffering from lack of moisture. As far as is known, it has only once previously been recorded in Australia, *viz.* by Professor Ewart in 1905, near the Snowy River, Victoria.

INSECT PESTS.

MEAAS OF PREVENTION AND CONTROL

188 - **Life-History of Syrphid Fly Predaceous on Froghopper Nymphs.** — GUPPY, P. L. in *Department of Agriculture, Trinidad and Tobago, Special Circular*, No. 8, 5 pp., 3 figs. Trinidad, October 23, 1913.

The writer describes the life-history of a syrphid fly, *Salpingogaster nigra*, which extends over 20 ½ to 21 ½ days. Its larvae attack the nymphs of *Tomaspis saccharina* ("Sugar Cane Froghopper") and *T. pubescens* ("Black Froghopper"). During the larval stage (9 to 10 days) each *Salpingogaster* destroys or sucks from 30 to 40 nymphs of the froghoppers. There is no doubt that this parasite destroys large numbers of very small larvae, wherever the latter are abundant. In two cases the writer found some adult froghoppers which had only just emerged from the nymph stage killed by the larvae of the parasite.

Salpingogaster nigra occurs wherever froghoppers are found. It is one of the most important of the natural enemies of the froghopper. It is its specific parasite, and it is hoped that it may be reared successfully on a large scale.

189 - ***Monolexis lavagnei* n. sp. (Braconidae) parasitic on *Sinoxylon sexdentatum* on Vine Shoots.** — PICARD, F. in *Bulletin de la Société entomologique de France*, 1913, No. 16, pp. 399-402, fig. 1. Paris, 1913.

Sinoxylon sexdentatum Oliv. is a Bostrichid beetle commonly found in the South of France on vine shoots, which it destroys. To the many enemies of this insect already well-known is now added a new species of Braconid, described by the writer as *Monolexis lavagnei*, distinct from *M. foersteri* March. This new Hymenopterous insect is not exclusively parasitic on *S. sexdentatum*; it has been taken from oaks attacked by *Scobicia pustulata* F. and by *Xylonites praeustus* Germ., and also from Corsican pine (*Pinus Salzmanni* Dun. = *P. Laricio* Poir.), attacked by *Pytiogenes* and *Pityophthorus*. The species is probably widely distributed in the South of France

190 - **Parasites of the Fruit Fly** (1) **in Africa.** — SILVESTRI, F. in *Estratto dal Bollettino del Laboratorio di zoologia generale e agraria della R. Scuola superiore di Agricoltura in Portici*, Vol. VIII, pp. 164, LXIX figs., 1 Map. Portici, 1913.

In those regions in which fruit growing is an important branch of agriculture and which possess a climate and soil suitable for its extension, much alarm has been felt, especially during the last ten years, at the spread of the fruit fly, *Ceratitis capitata* Wied (2). Whilst some entomologists sought

(1) See also No. 1404, *B.* Dec. 1913. (*Ed.*).

(2) See *B.* Dec. 1910, p. 375; No. 2028, *B.* June 1911; Nos. 3253 and 3281, *B.* Nov.-Dec. 1911; No. 1692, *B.* Dec. 1912; No. 182. *B.* Feb. 1913. (*Ed.*).

artificial means of control of the injurious insect, others endeavoured to find its parasites and to introduce them into the countries in which they did not yet exist. But the first results obtained were unfavourable and caused many to consider that the natural control of *Ceratitis* and other insects of the same genus and of the genus *Dacus* was impossible. The question was, however, taken up again in 1910, when the discovery of *Ceratitis capitata* in Hawaii (Honolulu), almost certainly introduced the previous year with Australian fruit, placed the serious problem before the islanders and obliged the authorities and entomologists to solve it.

The writer was invited by the Hawaiian Government to proceed to West Africa in order to seek there the parasites of the fruit fly, as that part of the world had not yet been explored from this point of view, while it was considered as the probable home of the insect. Sig. Silvestri's plan was the following: *a*) to ascertain by visiting the greatest number of colonies if *C. capitata*, besides being found in the Congo, existed in western Africa, in Senegal and to the south of that region, and if it was controlled by special enemies which might be advantageously introduced into Hawaii and into Italy (this country also being interested in the question); *b*) should *C. capitata* not be found, but some other allied species or insects of the genus *Dacus*, to seek their parasites and to experiment them on *C. capitata*, and if they held out promise of success to introduce them into Hawaii and Italy.

The writer left Europe on July 25, 1912, and visited the following localities: the Canaries, Dakar, French Guinea, Senegal, Southern Nigeria, Kamerun, the Gold Coast, Dahomey, the Congo, Angola, South Africa, Australia, Honolulu. He returned to Italy, reaching Naples in July 1913.

After some notes on the places he had been at and on the entomological researches carried out in each, the writer enumerates the fruit flies observed during his travels: *C. capitata*, *C. giffardii* Bezzi, *C. silvestrii* Bezzi, *C. stictica* Bezzi var. *antistictica* Bezzi, *C. punctata* Wied., *C. anomae* Graham, *C. colae* n. sp., *C. rubivora* Coquillet, C. *nigerrima* Bezzi, *C. tritea* Walker, *Dacus oleae* Gm., *D. armatus* Fabr., *D. bipartitus* Graham, *D. lounsburyi* Coquillet, *D. vertebratus* Bezzi, *D. brevistylus* Bezzi, *D. longistylus* Wied. The systematic description of these flies is accompanied by information as to their geographical distribution, host plants, life history, and in the case of *C. capitata* and *D. oleae*, as to the injury caused by them, and the artificial and natural means of controlling them.

The writer then gives the systematic description, geographical distribution and life history of the numerous parasites of the species of *Ceratitis* and *Dacus* observed and collected during his journey. They belong to the following families.

a) Braconids: *Opius concolor* Szépl., *O. dacicida* Silv., *O. lounsburyi* n. sp., *O. dexter* n. sp., *O. perproximus* n. sp., *O. perproximus* var. *modestior* n. var., *O. humilis* n. sp., *O. inconsuetus* n. sp., *O. inquirendus* n. sp., *O. africanus* Szépl., *O. africans* var. *orientalis* n. var., *Hedylus giffardii* n. sp., *Diachasma fullawayi* n. sp., *D. fullawayi* var. *robustum* n. var., *D. tryoni* Camer., *Biosteres caudatus* Szépl., *Sigalphus daci* Szépl., *Bracon celer* Szépl.

b) Proctotrupids: *Galesus silvestrii* Kieffer, *G. silvestrii* var. *robustior* n. var., *Trichopria capensis* Kieffer.

c) Chalcids: *Dirhinus giffardii* n. sp., *D. ehrhorni* n. sp., *Spalangia afra* n. sp., *Tetrastichus giffardii* Silv. (1), *T. oxyurus* n. sp., To these the writer adds *Syntomosphyrum indicum* Silv. (2), as it is a species which may be very useful, at least in tropical countries, and should be introduced into Hawaii.

d) Formicids: *Dorylus affinis* Schuck, *D.* (*Anomma*) *nigricans* Illig. var. *hybrida* Santschi, *Aeromyrma vorax* Sanstchi.

From the writer's researches the following facts are established.

1) In West Africa various species of *Ceratitis* and *Dacus* exist, some of which, at least in the months in which the writer observed them, were so reduced in numbers as to lead one to believe that they were effectively controlled by natural enemies.

2) A certain number of Braconids (of the genera *Opius, Diachasma, Hedylus, Biosteres*), of Chalcids (of the genera *Tetrastichus, Spalangia*) and of Prctotrupids (of the genus *Galesus*) are perhaps the most active enemies of fruit flies in West Africa, without however excluding other natural enemies, such as insect egg-parasites, bacteria and fungoid parasites of the larvae.

3) In Nigeria and in Dahomey the writer has ascertained the presence of *C. capitata*; it was however, at least from November to February, extremely rare; this is probably due to the same parasites discovered by the writer for the other species of *Ceratitis* and *Dacus*, without however excluding the possible existence of other enemies.

4) Several hymenopterous parasites of any one species may attack different species of *Ceratitis* and *Dacus*.

5) Parasites of *C. giffardii* and *C. anonae* were experimented by the writer with *C. capitata* and they developed well.

6) The writer conveyed to Honolulu living adult specimens of *Opius perproximus, Dirhinus giffardii, Galesus silvestrii* from West Africa, of *O. humilis* and *Trichopria capensis* from South Africa, of *Diachasma tryoni* from East Australia; from Honolulu to Portici, Italy, he brought specimens of *Dirhinus* and of *Galesus*.

7) *Dirhinus giffardii* and *Galesus silvestrii* were multiplied and distributed in large numbers at Honolulu, and *Diachasma tryoni* and *Opinus humilis* in smaller numbers; in Italy, *Dirhinus* and *Galesus* were distributed.

8) Concerning the results of such distributions nothing can be affirmed until the acclimatisation of these species is ascertained; but supposing it to succeed, at least in Hawaii, wlth *Diachasma, Opius humilis, Dirhinus* and *Galesus*, a considerable destruction of *C. capitata* is to be hoped for.

9) In case *Diachasma tryoni* does not become acclimatized owing to the small number of specimens imported into Hawaii, it will be necessary to import as soon as possible large numbers of them from Aus-

(1) See No. 1404, *B.* Dec. 1913 (*Ed.*).
(2) See p. 375 *B.* Dec. 1910. (*Ed.*).

tralia, the importation of this parasite from Australia to Hawaii being very easy. The introduction of other Braconids of the genera *Diachasma* and *Biosteres*, parasites of *Anastrepha*, from Mexico and Central America, is advisable before again attempting the introduction of Braconids from Africa, because owing to the distance of this country from Hawaii and the nature of the parasites, their arrival in good condition is very difficult, whilst their introduction into Italy from West Africa is easy.

10) It is important, and according to the writer even necessary, to study *C. capitiata* further in West Africa, and to ascertain if it is attacked by *Tetrastichus giffardii*; if so, attempts should be made to introduce the parasite into Hawaii and Italy.

11) It would also, in the opinion of the writer, be very useful to extend the study of *C. capitata* and other fruit flies in East Africa from Natal to Uganda, because it is possible that other good parasites exist in those regions.

12) He advises also the importation from India into Hawaii of *Syntomosphyrum indicum* and to study the other parasites of the genus *Bactrocera* in India, as among them there might be some very useful for the control of *B.* (*Dacus*) *cucurbitae* and some suitable for *C. capitata.*

13) For the olive fly (*Dacus oleae*) it is necessary in the first place to attempt the introduction and acclimatisation of *Opius concolor* from Tunis, then the parasites that are already known and others that may be discovered in Eritrea; if these should not afford the desired results, the parasites from South Africa will have to be imported and those which may be discovered in other parts of Africa and in Asia.

14) It is of the greatest importance for Italy to study the olive fly in Tripolitania, where no mischief is reported, and in Eritrea, where many species of parasites of the fly are already known. These researches might perhaps lead to the solution of the grave problem of the control of the fly and would at all events be very useful in extending our knowledge of the life-history of the fly and of its enemies.

The work ends with a rich bibliography.

191 – **Some Factors affecting the Susceptibility of Cucumber Plants to Burning from Hydrocyanic Acid Gas** (1). — STONE, G. E. in *Annual Report of the Massachusetts Agricultural Experiment Station,* Year 25, No. 31, pp. 61-72 + 1 plate. Boston, January 1913.

Experiments on the fumigation of cucumber plants with hydrocyanic acid gas in glass houses of different illumination gave the following results:

(1) See also *B.* Dec. 1910, p. 382. (*Ed.*).

Average of three experiments	Number of compartment				
	1	2	3	4	5
Relative intensity of light * %	24.40	26.60	48.10	74.00	100.00
Average height of plants . . cm	22.30	23.30	17.30	19.90	15.50
Average diameter of stem . »	0.44	0.53	0.53	0.66	0.78
Average length of internodes »	7.30	7.00	5.90	4.30	4.00
Length × width of leaves. sq. cm.	70.90	90.30	62.60	80.20	85.50
Effect of fumigation on leaves **	all burnt or killed	burnt, few killed	some only burnt	traces of burning	no burning

* The relative light intensities were determined by chemical methods. The varying light conditions were obtained by means of cloth screens of various grades from mosquito netting to fine muslin.
** All the plants were fumigated with 0.007 gram of cyanide per cubic foot during 1 hour.

Experiments on the effect of varying quantities of soil moisture on the susceptibility of cucumber plants to burning by hydrocyanic acid gave the following results:

Average of three experiments	Number of pot					
	1	2	3	4	5	6
Percentage of moisture * . . .	10.00	15.00	20.00	50.00	60.00	70.00
Average height. . . . . . . cm.	6.20	7.50	10.20	13.00	17.50	21.20
Average length of internodes »	4.20	4.50	5.20	5.50	7.50	8.2
Average length of petioles . »	1.30	1.7	2.2	3.20	4.00	3.2
Average diameter of stem. . »	0.30	0.30	0.40	0.45	0.55	0.50
Average length × average width of leaf . . . . sq. cm.	6.25	39.5	67.5	162.50	225.00	285.0
Effect of fumigation on leaves **	no burning	no burning	slight burning	nearly all leaves burnt		

* Percentages of the total water-retaining capacity of the soil, which was 47 per cent.
** Fumigation as before.

These experiments point to the conclusion that differences in the development of the tissues, whether brought about by inferior light conditions

or by excessive moisture in the soil, affect their susceptibility to burning under the influence of hydrocyanic acid.

Further experiments are being conducted to throw more light on the influence of other factors.

INSECTS INJURIOUS TO VARIOUS CROPS.

192 – ***Tapinostola musculosa*, a Noctuid Moth injurious to Cereals in Hungary.** — JABLONOWSKY, JOZSEF in *Köztelek*, Year 23, No. 99, pp. 3335-3337, figs 441-443. Budapest, December 24, 1913.

In 1913 a good deal of damage was done to crops of oats and barley on the Pusztapó estate in Hungary by the caterpillars of *Tapinostola musculosa* Hb.; some 40 acres were so badly infested that the crops had to be ploughed under.

This species occurs in most of Europe, except the extreme north, and in Central Asia; it was not previously recorded as injurious in Hungary, though in Russia it has been known to do enormous damage in some years, as in 1882, 1894 and 1899, when it was estimated that two-thirds of the crops were destroyed.

The larvae hibernate in the stubble or in rough grass at the edges of the fields, so that these places should be ploughed deeply if possible, or else burnt. Once they reach the grain crops, to which they move about the end of March, the damage cannot be prevented.

193 – ***Anthonomus grandis* var. *thurberieae* (a Cotton-Boll Weevil) on *Thurberia thespesioides*, in Arizona.** – PIERCE, W. DWIGHT, in *Journal of Agricultural Research*, Vol. I, No. 2, pp. 89-98, figs. 1-9, plate VI, Washington, D. C., 1913.

In February, 1913, considerable importance was attached in a preliminary report to the discovery of a Curculionid in Arizona (Ventana Canyon, Santa Catalina Mountains), resembling the Mexican cotton-boll weevil (*Anthonomus grandis* Boh.), whose injurious character is well known. The insect lives in the capsules of *Thurberia thespesioides* A. Gray (*syn. Gossypium Thurberi* Tod. and *Ingenhauzia triloba* Moç et Sesse), a Malvaceous plant indigenous to Mexico and Arizona, and known by the natives as "wild cotton", on account of its resemblance to the true cotton plant.

Examination of abundant material from several localities in Arizona has enabled the writer to distinguish this insect as a new variety of *A. grandis*, which he names var. *thurberiae*; it differs from typical *A. grandis* in several morphological, physiological and biological characters: the nature of its host (*Thurberia thespesioides*), its occurrence at higher altitudes (4000 ft) and the period of its development (mid-August to November). This variety might fly considerable distances in search of food, though it will probably confine itself to its natural host as long as there is sufficient of the plant to supply it with food. Supposing there were a shortage, the insects would naturally attack cotton first, and with disastrous results. Extensive destruction of *Thurberia* is therefore to be deprecated as tending to encourage the insect to adapt itself to the cotton. Thus the writer considers it would be better not to interfere with the present conditions, and suggests the introduction of parasites of *A. grandis* to reduce the numbers of the insect and keep it in check.

194 – ***Acheta morio*, an Orthopterous Insect injurious to Sisal in German East Africa.** — KRANZLIN in *Der Pflanzer*, Year IX, No. 11, pp. 568-570. Daressalam, November 1913.

The writer has observed on a number of year-old plants in certain parts of a plantation of *Agave rigida* var. *sisalana* a new type of damage not previously recorded on this crop. Portions of the lower leaves about an inch long had been eaten away, sometimes at the tip, but more often at the base, just above the junction with the stem. The damage differed from that caused by snails, which eat the upper surface to a slight depth, in consisting of holes cut from the edge of the leaf towards the centre; in some cases whole pieces of the leaf appeared to have been removed and certain leaves were nearly or quite cut off from the stem.

In places where the surface of the ground contained crevices or clods of earth, hardly a single plant had been spared. The writer, unable to ascertain the cause of the destruction in the day-time, visited the plantation at night and observed a large number of very small young of *Acheta morio* (Orthoptera) on the damaged parts, for which they were obviously responsible.

The localisation of the insect and its damage is explained by the fact that it only finds a suitable retreat during the day-time in places where the surface of the ground forms hiding-places in which it can live under damp conditions even in dry seasons. Such being the case, this insect cannot become a source of serious danger to the cultivation of sisal.

ALFREDO RUGGERI, *Gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE

BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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CONTENTS

FIRST PART: ORIGINAL ARTICLES

SECOND PART: ABSTRACTS

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

II. — CROPS AND CULTIVATION.

a) GENERAL

b) SPECIAL

III. — LIVE STOCK AND BREEDING

a) GENERAL.

b) Special

IV. — Farm Engineering

V. — Rural Economics.

VI. — Agricultural Industries.

PLANT DISEASES.

I. — General Information.

II. — Diseases not due to Parasites and of Unknown Origin.

III. — Bacterial and Fungoid Diseases.

a) General

b) Special

V. — Insect Pests.

a) General

b) Special

FIRST PART.

ORIGINAL ARTICLES

Agricultural Education in the Argentine Republic

by

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I. PRESENT ORGANIZATION

Agricultural education in the Argentine Republic may be classified under three heads: 1. Higher education given in the Universities; 2. Medium, elementary and continuation education provided by the Federal Government; 3. Agricultural education provided by some of the provinces and by special institutions or by national institutions connected with the above organization.

Higher university education. — This is given by the faculties of Agriculture and Veterinary Science, which form part of the National Universities of La Plata and Buenos Aires. The first of these two faculties was founded in 1813 in the present School of Agriculture and of Animal Husbandry at "Santa Catalina", which is now a practical school of agriculture annexed to the same institute. The second, situated in the neighbourhood of Buenos Aires at a place called "La Chacarita", was founded on September 25,1904. Both faculties include two sections, one for agricultural engineers, the other for veterinary surgeons. The programme is a four years' one. For admission the degree of "bachelor" granted by the National Colleges is required; failing this the candidates have to pass an examination equivalent to the above courses. The La Chacarita faculty differs from the one at La Plata in that it has organized arrangements for boarding the students which will be inaugurated in 1914. The teaching staff at La Chacarita is only to a limited extent composed of agricultural engineers and veterinary surgeons, while at La Plata almost all the professors hold such diplomas.

Both institutions are endowed with laboratories and museums which can compete with the best of the kind, and the cultivated lands and experiment fields that surround them are such as to meet all educational re-

quirements connected with the extensive type of agriculture prevailing in Argentina.

Most of the young men who take their degrees at these institutions find immediate employment in the national and provincial services, the requirements of which in this direction are always increasing. Some are engaged as managers of private undertakings and others again manage their own estates.

Secondary elementary and continuation education. — As has already been stated, the vast organization that includes all the institutions of this kind is under the control of the Federal Government, through the Ministry of Agriculture, of which one division called "General Board of Agricultural Education" directs all these services.

The General Board of Agricultural Education was constituted in 1906. It develops an organic scheme of education which includes:

a) — Practical instruction given in the District Practical Schools scattered over almost the whole of the country.

b) — Special or technical instruction given in the Special Schools.

c) — Continuation courses entrusted to local agronomists and other subordinate officials distributed in the most important agricultural and live-stock breeding districts.

d) — Experiment fields and experiment stations attached to the practical and special schools.

e) — District nurseries, devoted to the production and selection of forest and orchard plants and to their distribution in their respective districts.

a) — *Practical schools.* The instruction imparted by these schools and by the special schools is free of charge. It is local, in as much as it is restricted within the limits of the produce of each belt; it is specialized, as it is directed especially to that branch of agriculture or industry which characterizes the district in which the school is situated. These schools have adopted the system of lodging and boarding their pupils, who live in common with their professors and thus enjoy all the advantages of this system. The following are the eleven schools of Agriculture at present existing in the Argentine Republic:

1. — Dairy school at Bell Ville (Cordova).
2. — Agricultural school at Bella Vista (Correntes).
3. — Pomological school at San Juan.
4. — Subtropical school at Posada (Missiones).
5. — Forestry and industrial crops school at Colonia Benitz (Chaco).
6. — Agricultural school at Las Delicias (Entre Rios).
7. — Agricultural school at Puerta de Diaz (Salta).
8. — Agricultural school "25th of May" (Buenos Aires).
9. — School of agricultural mechanics at Bahia Blanca.
10. — Market - gardening and fruit - growing school at Tigre (Buenos Aires).
11. — Dairy school at Olavarria (Buenos Aires).

The Tigre, May 25th, and Olavarria schools will be in working order in 1914.

The practical schools do not follow a systematic plan as it is usually understood; the curriculum is determined by the kind of production that the school will choose during the scholastic year. The practical agricultural schools are organized in the same way as a model private farm and they aim at obtaining the best and most abundant product at the least possible cost and in such a manner as to allow the pupils to have a clear idea of the results obtained by the systematic methods adopted by the school. These practical schools have the object of forming employees capable of carrying out the special work performed in the schools, and the theoretical part of the teaching is limited to pointing out the reasons of the practical processes at the moment in which the latter are applied. The pupils are all boarders; the courses last three years (six half-years); the instruction, board, lodging, clothing, etc., are all free of charge. The school of agricultural mechanics at Bahia Blanca not being provided with the necessary installation for boarders, gives its pupils equivalent allowances in cash.

In order to stimulate the students' activity they are granted a daily remuneration of $10\frac{1}{2}$ *d*, 1*s* $3\,^3/_4$*d* and 1*s* 9*d* during the first, second and third year respectively; this remuneration may be diminished for bad behaviour or for insufficient application to study (the students must perform all the practical work done in the institution).

Besides, to encourage thriftiness, savings banks have been opened in the practical schools.

At the end of the courses the students get a diploma certifying to their competence in the special branch which they have studied. This diploma however is not available in competitions for public employments because the object of these institutions is to turn out good and capable agriculturists. These schools also try to find situations for their pupils in the district, furnishing all the necessary information and proposing those candidates that seem most suitable for capacity and morality.

The school half-years embrace the periods of the greatest agricultural and industrial activity; there are two yearly vacations of 15 days each; the working hours are the same as those adopted in private establishments; the time spent in the classes does not exceed one hour per day and is used only to take notes and to prepare the calculations and the drawings necessary for the operations of farming and industrial practice.

For admittance to one of these practical schools the following are the requirements: Age: above fifteen (birth certificate). Health and physique suitable to the special work to which the pupil intends to devote himself (medical certificate). Reading and writing correctly and a knowledge of the four fundamental operations of arithmetic. For this, examinations will be held between the 1st and the 6th of January in the school itself or elsewhere according to instructions. Applications are received between the 1st and the 15th of December.

b) *Special or technical schools.* — The special schools are also local; they not only train their pupils in one given branch of agriculture, but they endeavour to develop in them a commercial spirit by making them assist in all the operations connected with transactions over the produce of the establishments, thus contributing to form their individual judgment. These schools, like the preceding ones, are boarding schools. In the school for vine growing and wine making at Mendoza the boarding system has not yet been adopted on account of the required premises. Not more than 25 pupils are admitted at a time in order to have full efficiency of instruction. The school year begins on March 1 and ends on December 31, with two months vacation.

In order to be admitted to the special schools the following conditions are required: 1) Age, not less than 17 years (certificate of birth or equivalent document); 2) Health and physique suitable to the work the pupil will have to perform (medical certificate); 3) Certificate of having passed the fifth class of the communal schools or passing an equivalent admission examination.

Free places are granted to Argentine condidates who comply with the above requirements and satisfactorily prove that they are not in a position to meet the necessary expenses.

The pupils are boarders, except at Mendoza; they may be paying pupils or free of charge. The former pay £ 8 15 *s* per quarter, payments in advance. Those who obtain the free places are boarded, lodged, clothed, etc.

The Mendoza school disposes every year of 25 free places or scholarships of £ 4 7*s* 6*d*, which sum is paid in cash. The other schools grant scholarships in proportion to the merits of the students and to the finances of the institution. The expenses due to those who have free places form part of the general expenses and of the working expenses appropriated in the budget. The scholarships are only granted to Argentine subjects in straitened circumstances and, other conditions being equal, the sons of farmers and people engaged in industry are preferred.

The special schools open at present are the following:

School of vine growing and wine making at Mendoza; School of fruit growing and sugar making at Tucuman; School of agriculture and animal husbandry at Cordova; School of agriculture at Casilda (Santa Fé).

The Casilda school is an intermediate type between the special and the practical school. The pupils who leave it bear the title of farm managers (Administratores Rurales).

The vine-growing school of Mendoza possesses vineyards and a model cellar. It gives the diploma of vine grower and œnologist. The curriculum extends over three years besides a preparatory course.

The courses at the school of agriculture and of animal husbandry at Cordova have the same duration. The students on leaving get the title of experts in agriculture or animal husbandry. They can then follow the higher courses at the National Faculties of Agronomy or Veterinary Science.

At the Tucuman school of pomology and sugar making the courses extend over four years, the first of which is preparatory; then come two years

of general study and one of special study in the sugarcane industry. On leaving, the students get the title of experts in fruit growing and sugar making. In order to increase the practical efficiency of the training, a factory for the extraction of sugar from sugarcane is being erected at the school.

c) *Continuation education.* — This instruction is imparted by local agronomists. The Republic is divided into twenty districts, to each of which one of these agronomists is appointed. This official has the duty of spreading among the rural population of his district instruction about the crops, for the benefit of the men, women and youths who cannot follow the regular school courses. These local agronomists, assisted sometimes by a subordinate staff, conduct temporary courses, travelling lectures, cooperative experiments, and demonstration trains. The temporary courses are held for the children attending the primary schools, for adults and for soldiers also. During the vacation the schools of agriculture organize short courses on special subjects.

Several railway companies have placed special trains at the disposal of the district agronomists, who give lectures, information and advice in the above trains, as well as in ordinary trains, in farms and on the premises of agricultural associations.

The cooperative experiments are intended to improve local production ; they extend the field of action of the experiment stations and of the schools of agriculture to those localities which lack such institutions, and assist in verifying and demonstrating the experiments made in them. The experiments conducted by the co-operation of the State with private persons are as numerous as possible in the area entrusted to each district agronomist. They are a happy combination of official and private initiative and fully justify their title, because the State supplies the seeds and the technical management of the experiments, whilst the other party provides the soil, labour and other necessary factors. This organization is completed by the continued and persevering assistance of the General Board of Agricultural Education in all the competitions and shows (national, district and local) which take place in the district, and by the stimulating action of the institutions under the Board on everything connected with the founding and organizing of societies, syndicates and agricultural co-operative associations.

d) and e) *Experiment stations and district nurseries.* — These institutions must also be mentioned for their importance and because they complete the whole system of agricultural education. The experiment stations, which like the experiment fields are attached to the schools, are provided with a special staff which teaches the pupils experimental methods. They are a complement to the schools both from their position and from their administrative dependence : they are in fact placed under the scholastic jurisdiction and employ in their work the same means and the same factors, at the same time that they enjoy a complete scientific independence as to their researches. There exist also other experimental institutions of recent foundation under the Board of Agriculture and Agricultural Defence

(Direccion de Agricultura y Defensa agricola), which forms another division of the Ministry of Agriculture.

The technical experts of agricultural education, considering experimentation as inseparable from tuition, constantly demand unity of action, vindicating their tradition as initiators of experimental research in the country.

Agricultural educationpossesses also some special establishments called district nurseries, devoted to experimentation and more particularly to the multiplication of forest plants. Thanks to these establishments and in proportion to the progress of the buildings, rural organizations and agricultural improvement of the soil, the Board forms gradually a new nucleus suitable to the institution of a new school according to an established plan. Some of these establishments have been placed under the control of the Board of Agriculture and Agricultural Defence.

Such is the national organization of agricultural education under the Ministry of Agriculture. It forms a harmonious whole which renders valuable service to the progress of Argentina and to the unceasing development of the agricultural industries of the country.

II — Complementary organization.

a) National institutions with agricultural sections. — In order to complete the review of the national agricultural education, notwithstanding the fact that the principal character of the following institutions is different from that of the schools of agriculture, it is worthy of note that agricultural instruction is imparted in the Reformatory at Marcos Paz (Province of Buenos Aires) under the control of the Ministry of Public Instruction, and that agricultural work is carried out at the lunatic asylum called the Open Door near Lujan (Prov. of Buenos Aires).

b) Agricultural education in the provinces. — The Province of Buenos Aires has possessed for the last two years the School of Pomology at Dolores. Its organization and working are very similar to those of the national practical schools. It disposes also of two important nurseries, situated at Baradero and Cazon.

The Province of Entre-Rios has founded and maintains five schools: 1. The "Alberdi" Normal School for Rural Schoolmasters, situated near Paranà, the capital of the Province. — 2. The Agricultural, Animal Husbandry and Industrial School at Villa Urguiza, also near the capital. — 3. The Don Cristobal Agricultural School (District of Nogoyà). — 4. The "General Urquiza" Agricultural School (District of Villaguay). — 5. The Agricultural School at Concordia.

The courses in these schools extend over three years.

The "Alberdi" school prepares rural teachers for the elementary schools in which notions of general and special agriculture, of animal husbandry and of agricultural industries are given. The other schools turn out farm bailiffs and industrial foremen.

The Province of Sante Fè has instituted experiment fields in the district of Irigoyen, where varieties of cereals and forage plants are experimented; it possesses also an experiment and demonstration field at the rural school at Godoy.

The Province of Cordoba has founded an agricultural office for the spread of notions of agriculture by means of departmental agronomists.

The Province of Mendoza has possessed for some years a Practical School of Agriculture at San Rafael.

c) *Special institutions for agricultural education.* — In the Argentine Republic there are also schools of agriculture kept up by private associations or by religions corporations; these schools have in part the character of asylums for abandoned children.

Special mention must be made of the "Nicanor Ezeiza" Practical School of Rural Industries, founded by a group of inhabitants at Coronel Vidal (Prov. of Buenos Aires). This school is subsidized by the Government of the Province and will probably soon belong to it. It disposes of an estate of 617 acres with garden, nurseries, courts, pigstyes, lucerne fields, etc., and will soon have a butter and cheese dairy and a herd of 50 cows.

The school has been open two years, and its nurseries have already provided about 50 000 forest and fruit trees and during the year the number will reach 100 000.

The "Patronage for Children" maintains at Claypole (Prov. of Buenos Aires) an agricultural school with upwards of 200 children.

The Basque scholastic institution "Euskal Echea", founded by the Euskarian community for the education of Basque Argentine children, possesses an agricultural school at Llavallol (Prov. of Buenos Aires) in an estate 50 acres in extent. The school is managed by Capuchin fathers, who give 100 children elementary education and a course of agricultural theory and practice divided into four years.

The Salesian fathers control four important establishments in the Republic:

1. "Don Bosco" agricultural school at Uribelarrea (Cañuelas, Prov. of Buenos Aires) with 1062 acres of land. It keeps 40 pupils. — 2. "San Pedro" College at Fortin Mercedes (Rio Colorado), 97 miles from Bahia Blanca, with 100 pupils. — 3. "Don Bosco" School of vine growing and market gardening at Rodeo del Medio (Prov. of Mendoza), with 100 pupils. — 4. "San Jose" agricultural school at Roca (Rio Negro), which occupies 1235 acres of irrigated land and teaches upwards of 50 pupils.

The Salesian fathers possess at Bernal (Prov. of Buenos Aires) 50 acres of land devoted to experimental cultures and to the production of fruit.

The "Niño de Dios" agricultural and industrial school at Victoria (Entre Rios) is managed by Benedictine fathers and disposes of 840 acres.

The Present State of Irrigation in Germany

by

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Up to within the last few years, irrigation in Germany was limited to water meadows, of which the oldest records date back to the 16th century. Though for several decades information on the irrigation of fields and gardens in other countries awoke a certain interest, nothing was done in this matter because the returns from the land without irrigation were satisfactory and because the rainfall in Germany was considered sufficient to ensure full crops. While irrigation flourishes principally in those countries where the yearly rainfall does not average more than 250 mm. (10 inches) and is moreover unfavourably distributed in the course of the year, Germany has no part of its territory that gets less than 400 mm. (16 in.), and of this quantity a great part falls during the time that plants grow (summer). Nevertheless it is not only the question of the total amount of rainfall occurring in a length of time, but also that vegetation should be spared periods of drought, even if these be only temporary. Already Hellriegel (1) had shown by means of pot experiments how injurious to the crops quite temporary spells of drought are, in spite of subsequent abundance of water. Still more conclusive are the results of lysimeter experiments which indicate the amount of water required for the production of 1 lb. of crop or of dry substance, and compare the quantity of water required for the production of a good crop with the rainfall. The figures thus obtained are in truth distant from each other. Thus, for instance, much larger quantities are required when water is given in excess or when irrigation is practised with insufficient manuring. The limits are not too far apart when the consumption of water required for the production of the heaviest crop, if sufficiently manured, is considered per unit of water (2); this must be the aim of the whole irrigation problem.

The Kaiser Wilhelm's Institute of Agriculture founded at Bromberg in 1906, and especially its section devoted to land improvements, considered it one of its chief duties to study the water requirements of field crops and consequently the profitableness of field irrigation.

By means of the lysimeter experiments carried out there, it was found that the total evaporation from plants and soil during the period of vegetation in relation to the rainfall stood as shown in Table 1.

(1) Hellriegel: *Grundlagen des Wasserbaues*, p. 452 11.

(2) *Mitteilungen des Kaiser Wilhelms Instituts zu Bromberg*, I, 373; II, 163; III, 171; IV, 118 and 132; V, 210.

TABLE I.

Year	Crop	Months								Total	
1909	Oats	IV		V		VI		VII		IV to VII	
		mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.
Rainfall	—	51	2.00	5	0.20	43	1.69	65	2.56	164	6.45
Evaporation	—	17	0.67	73	2.87	206	8.10	162	6.97	458	18.02
1910	Rye	IV		V		VI				IV to VI	
Rainfall	—	33	1.30	64	2.51	109	4.29			206	8.11
Evaporation	—	59	2.32	158	6.22	148	5.83			365	14.37
Mean Rainfall	—	34	1.34	48	1.89	58	2.28	65	2.56		

The last line of the above table represents the average rainfall for Bromberg according to observations extending over upwards of 60 years, from which it appears that 1909 was a dry year and 1910 a wet one. But in both cases the amount of water required by the plants was considerably above that offered by the rainfall, and in some months to such an extent that it is doubtful whether without irrigation the soil would have been able to supply the deficiency from its store (subsoil water), especially in soils possessing a low water capacity, which are the first to be considered for irrigation purposes. The results obtained in both years by irrigation confirm this doubt. The unwatered plants were evidently injured by the spells during which their need of water was not fully covered by the rain. The same results were obtained in all the irrigation field experiments carried out at Bromberg. Even in the wettest years, to which especially 1912 belongs, there are some short periods of drought, and consequently irrigation proved beneficial, as may be seen from Table II.

In only two out of the six years during which experiments were made was the rainfall inferior to the average (205 mm. = 8.07 in.), and yet every year considerable increases of crop followed upon irrigation. The increases are higher than those obtained in similar experiments in America, especially if their higher market value in Germany is considered. There are, in Germany, extensive territories which lie under the same climatic conditions as the experiment field at Bromberg; about 8 150 000 acres have a yearly average rainfall of less than 500 mm. (about 20 in.), and besides these there are extensive areas with greater rainfall which yet suffer from frequently recurring shortage of rain. From the above it may be concluded that in Germany irrigation has a great future before it.

There are, however, two circumstances which tend to act as limiting factors. One is that, according to experience hitherto gained, only light

TABLE II.

YEAR	Rainfall IV-VII		Crop	Yield per acre				Increase per acre of watered plot *		100 cub. ft. of water produced
				dry plot	Watered plot					
	mm.	in.		cwt.	mm.	in.	cwt.	cwt.	£ s d	d
1907	298	11.7	Oats	12.74	115	4.5	19.11	6.37	3 9 10	5.09
1908	237	9.3	«	9.56	140	5.5	19.11	9.55	5 9 11	6.59
1909	163	6.4	»	11.95	140	5.5	24.69	12.74	5 19 0	7.13
1912	276	10.9	»	23.90	20	0.8	27.88	3.98	1 19 3	16.48
»	»	»	»	23.90	100	3.9	28.67	4.77	2 8 9	4.10
1909	163	6.4	Potatoes	136.20	110	4.3	258.07	121.87	7 11 2	11.52
»	»	»	(Starch)	22.30	110	4.3	47.79	25.49		
1911	105	4.1	Potatoes	62.13	280	11.0	209.49	147.36	—	13.72
»	»	»	(Starch)	11.15	280	11.0	43.81	32.66		
1910	294	11.6	Winter rye	15.93	80	3.1	19.11	3.18	1 15 8	3.73
»	»	»	Spring rye	9.56	70	2.8	12.74	3.18	1 10 2	3.50

* The cash value of the increase of crop was calculated at current market prices.

soils seem to be suitable for profitable irrigation, though it must also be noted that up to now irrigation experiments on heavier soils have been conducted to a very limited extent and require to be completed. The second obstacle lies in the extraordinary difficulties in the way of procuring the necessary water, because almost everywhere older water rights are encountered; one might almost say that every drop of water is somebody's property and is not to be had without indemnifying the owner. Besides this, it is not everywhere that water is to be found within accessible distance of the fields to be irrigated. To a great extent this difficulty is met by providing subterranean water by means of wells, but even this not easily available and expensive source is threatened, because according to the new Prussian laws on water, an indemnity must be paid to neighbours who suffer any loss by the tapping of underground water, whereas formerly every landowner was absolutely free to use any subsoil water he found on his property.

While these difficulties are to be regretted, as there is no other utilization of water as profitable as that of using it for irrigating fields and gardens, circumstances must be taken as they are; and consequently only

such irrigation systems as allow of the smallest consumption of water have been adopted.

Experiments made with wasteful furrow irrigation soon showed that there was too much loss of water by infiltration before it reached the places where it was required. This system allows only of an unequal distribution of water and is applicable only in especially favourably situated localities. There remains then only sprinkling from above like rain. With this method also there are losses, because the water adhering to the leaves and stems of the plants is evaporated and almost completely lost as plant food. Still this loss is relatively small, and sprinkling allows of a uniform distribution of the water over the field without any preparation of the latter.

In order to apply this system of watering, the water must be sent to the field under pressure in pipes; by this means it can be sprinkled on the land so that it all soaks into the soil and none flows off the surface. On light soils it has been found that the density of the rain must not be above 1 mm. (0.039 inch) per minute, if this condition is to be fulfilled. In the oldest installation of this kind — at Eduardsfelde near Posen — the town sewage was used in this way and sprinkled by means of hose piping attached to the pipes conveying the liquid under pressure. This system requires much labour and has further the drawback that in sprinkling by hand a uniform distribution of the water is not attainable, and consequently the method is liable to be connected with waste of water (1). Owing to the recognition of this fact, the mechanical distribution of water by means of moveable carts has been adopted; this method requires less labour to accomplish the same amount of work and does it more uniformly.

At present three such systems are in use and they are named after their inventors: Hartmann, Von Szczepkowski and Rodatz. A full description of the details of each system would be out of place here, besides which it has been given in other publications (2). All three systems have in the main given satisfaction. The injury they have caused to the fields, if any, has been very small. If in their details there are still some weak points, these may be considered as trifling, due to the novelty of the thing and to be soon overcome. To this end a prize offered by the "Deutsche Landwirtschafts Gesellschafts" will contribute greatly.

Besides these three systems of portable apparatus, two systems of fixed apparatus for the watering of gardens are to be mentioned: one by Herr Pusch, Civil Engineer (Berlin) and the other in use at the seed-breeding farm at Quedlinburg. The cost of an installation for watering fields is considerable and so is its working. The greater part of the expense is represented by the costly iron pressure pipes. When these are fixed and laid under the ground the complete plant costs from £ 8 to £ 10 per acre,

(1) *Mitteilungen des Kaiser Wilhelms Instituts*, V, 220.

(2) *Deutsche landwirtscaftliche Presse*, 1912, Nos. 3 and 4; *Veröffentlichungen der Oekonomischen Gesellschaft in Dresden*, 1913; *Mitteilungen der D. L. G.*, 1913, Parts 7 and 18. (See also No. 486, *B.* March 1912, where illustrations of two systems are given. — *Ed.*).

without the steam engine, which however need not be specially reckoned, because most large farms possess one which is not required for other work when the time for irrigating comes round. Much cheaper than the above, especially for large estates, are portable pressure pipes, which diminish the cost by about one-half. If the field to be irrigated is especially favoured by its form and situation as regards the water supply, the cost of installation can sink to £2 per acre and even less (1). Recently, also, reinforced concrete works have already been partially successful in their attempts to manufacture cement pipes reinforced with iron, able to stand high internal pressure. If they should succeed completely in producing a cheap substitute for the expensive high-pressure iron pipes, the cost of field irrigation plant would be very much reduced.

The average amount of water required for the intensive irrigation of the various crops may be assumed to be about 14 000 cub. ft. per acre per year. Recently the question has been much discussed whether extensive irrigation, that is for a given quantity of water irrigation of a large area with small quantities of water, is to be preferred to intense irrigation of a smaller area. It appears as if the decision will be in favour of extensive irrigation, as some experiments made in the United States would show (2). Should this really be further confirmed, the cost of the plant and of the labour per unit of area would be still further reduced.

The increases of yield obtained by irrigation on the experiment field at Bromberg have not failed to draw the attention of practical farmers, with the result that at present in the dry east of Germany already about 5 000 acres of arable land, belonging to 15 farms, are under irrigation. One estate has set up a plant for about 2 500 acres, with a central electric station to supply the necessary power. The attempt to sprinkle a dry meadow was followed by a great increase of gross returns, but by no net profit (3). Grass makes great demands upon the quantity of water, but yields a hay of relatively low value, which does not pay the expense of water under pressure.

In general all the experiments made on the irrigation of various crops show that the net profit due to irrigation varies with the market value of the crop. Owing to this being recognized in Germany, the installations for the watering of orchards and market gardens are increasing in numbers. While market gardens can be treated by sprinkling, orchards do not stand it well, as the fruit is liable to be damaged by it. Besides, sprinkling between the trees can be carried out only with difficulty even with a hose. It is therefore advisable to water orchards by furrow irrigation, as is done in the United States.

In conclusion it may be stated that at present in Germany also, the interest in irrigation is widely felt, as the considerable application of this clearly shows. If recently complaints about the celebrated irrigations in

(1) *Mitteilungen der D. L. G.*, 1913, Part 18.
(2) *Illustrierte landwirtschaftliche Zeitung*, 1913, No. 41. (See No. 228, *B.* March 1913. - *Ed.*)
(3) *Mitteilungen des Kaiser Wilhelms Instituts*, IV, 123.

the United States have reached us (1), we need not fear that any such unpleasant surprises await our irrigation schemes, the composition of our soil and the method of sprinkling that has been adopted here being sufficient guarantee. But as has already been stated, the area of the land which should and can be irrigated is not large; consequently irrigation in Germany will never have a great economic importance.

Nevertheless, considering the success already attained, no favourable occasion for the installation of an irrigation plant should be neglected.

Seed Control in Austria and its Effect upon Agriculture and Trade

by

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Director of the Vienna Seed Control Station.

The beginning of the regulation of the seed trade in Austria coincides with the founding of the Vienna Seed Control Station in 1881 by the Imperial and Royal Agricultural Society of Vienna (K. K. Landwirtschafts-Gesellschaft).

The chief aims of this station were not only the elaboration and improvement of the scientific methods of examination of the various seeds of commerce as to their quality, and the organisation of seed control in itself, but also the carrying out of investigations and experiments in the agricultural study of seeds, on forage growing and later on seed breeding, in connection with several field experiments on the agricultural value of the often highly advertized seeds placed on the market and sent in for analysis. Owing to its present sphere of activity as an independent botanic experiment station, the Vienna Seed Control Station has been taken as a model in the institution of similar stations elsewhere in Austria and abroad.

It started 32 years ago with very modest beginnings and has now developed into an agricultural institute upon whose many-sided activity great calls are made, and which at present is the largest experiment station of the kind.

Up to the year 1886, the Seed Control Station was situated in one room rented in a private dwelling, and limited itself to the examination of the most important seeds of commerce. At the initiative of the writer, who since the foundation of the Institute has been connected with it, the station was transferred to the premises of the Imperial and Royal Agricultural Society and its activity was extended beyond the analyses of commercial seeds, in the new direction of experiments principally on forage and cereal crops.

(1) *Kölnische Zeitung*, 1913, No. 153.

In 1895 the Station was taken over by the State and removed to the building of the Ministry of Agriculture, where it remained until 1895, when, through the munificence of the Emperor, a plot of land about one acre in extent in the Prater was secured; on this a building for the station was erected, surrounded by a garden suitable for small cultivation experiments.

WORK OF THE STATION.

I. — *Examinations* (*analytical work*). — In the first place the determination of the practical value of the various seeds of commerce, namely *authenticity*, genus and species, *origin*, *dodder content*, *degree of purity* in percentage by weight, *germination capacity;* further the *water content* (in seeds, fruits and tubers). Then there are examinations of sugar beet and mangold seeds as to impurities, germination capacity, number of clusters per gram, etc.; and for cereals, the *hectolitre-weight*, the *absolute weight* of the grain, total weight and percentage of sprouted, broken, bruised, gnawed, smutty or ergoted grains; further, in the examination of *bread cereals* or of their meal, the *baking value* is ascertained. *Barley* for the brewery is submitted to a complete analysis for water content, purity, hectolitre-weight, absolute weight, proportion of husk, mealiness, plumpness, grade, content of crude protein, purity of variety, proportion of damaged grains, germination capacity; and germination energy. The Station also examines *concentrated foods* (bran, meals, oilcakes, etc.), and this not only to determine their purity or possible adulteration, but also (according to Weinzierl's mechanical and microscopical method) their meal and husk content; the colour of the meal is also determined with the object of judging its type. Lastly, the Station determines the species of cultivated plants or weeds, investigates plant diseases, examines *hops*, carries out complete botanical analyses of hay and undertakes researches on plants and parts of plants of importance to agriculture.

No slight aid to the constant progress of the systematic cultivation of forage crops has been afforded by the Station during nearly a quarter of a century by its formulae for *seed mixtures* issued at the request of farmers for seed leys, permanent meadows, pastures, alpine pastures, etc.

Of great importance for regulating the trade in clover seed, especially as regards the essential quality of freedom from dodder, has been the practice adopted by the Station since 1882 of sealing with leaden seals the sacks of seeds in the merchants' warehouses. This practice is a speciality of the Station and has been followed by other experiment stations.

As for the use made of the Station by the public, it need only be stated that in the year in which it was founded the number of analyses carried out, including sealing of sacks, was 122, while last year (1912) the number rose to about 30 000.

In 1907 a branch station was opened in the Agricultural Exchange in Vienna; it was the first of its kind and proved to be a valuable adjunct. It is situated in immediate proximity to the common Exchange hall and is connected with it by means of a hatchway which allows people in the

Exchange to submit the samples presented for sale to a summary investigation on the spot, and to get immediate results upon which commercial transactions may be based.

II. — *Experimentation* (*field experiments*). — Among the duties of the Seed Control Station as an agricultural botany experiment station the following are the most important:

1. Encouraging the cultivation of forage plants by carrying out field experiments with them, installation of forage crop stations, cultivation and breeding of forage plant seeds, experimental growing of forage crops in the Alps. The last-named are made in the experiment garden on the Sandling Alp near Bad-Aussee, and in other alpine seed gardens instituted by agricultural associations or by the authorities in Austria at the initiative of the seed Control Station; further, since 1909 experiments have been made at the Imperial and Royal Kragl estate, near Mitterndorf; the breeding of grasses and pasturing, and plants useful as litter have been dealt with on special experimental areas.

2. Promoting the breeding and cultivation of cereals, flax, beets and mangolds, potatoes, maize and forage plants, as well as plant breeding in general, by means of experiments intended for the improvement of the varieties of the country and for the breeding and spreading of new and suitable varieties on the one hand, and for keeping up the productivity of the foreign varieties that have been introduced and found advantageous, on the other. Lastly, the results of these scientific and practical field experiments are made known by means of publications, lectures, courses and demonstration plots.

3. Stimulating the formation of organisations for the furthering of agricultural crop production, especially the raising and breeding of seed, in peasant farms or by agricultural associations.

4. Lastly, the furthering of the scientific bases of agricultural crop production in general, especially by means of scientific investigation in the study of seeds, on the question of the formation of new plant forms in the most important crops, etc.

For carrying out small experiments of cultivating new varieties of cultivated plants, seeds of doubtful origin, breeding experiments, etc., the garden of the Station containing fifty plots, making together 0.827 acre, is available. For experimentation in winter there is a glass house built in 1907 in the garden of the Station.

METHODS OF SEED CONTROL.

With the object of obtaining uniformity in the methods of seed control in Austria, a special expert commission for seed control under the presidency of the writer was appointed under the Federation of Agricultural Experiment Stations founded in 1911. This commission drew up and published, in a book (1) dealing with the methods to be followed, the spe-

(1) *Methodenbuch. Niederschrift der für den Verband der landwirtschaftlichen Versuchsstationen in Oesterreich ab* 1. *Januar* 1913 *geltenden analytischen Verfahren und Grundsätze.* — Published by the above Verband, Wien II., 1st. Edition with 9 figs. Vienna, 1913.

cial instructions which have been enforced since January 1,1913, and which in their main lines are the following:

For every examination a small *average sample* is made up from the sample sent in.

The determination of the *authenticity* consists in determining whether the sample agrees with the designation given to it, as to genus and species. The authenticity of a variety is at the request of the sender to be determined by an experiment in the open.

The very various places of origin of the clover seeds found in the trade are to be indicated by one of the following fixed denominations: Central European, South European, West European, North European, East European, North American, South American, Asiatic and Australian.

a) European seeds whose origin cannot be ascertained for certain are to be designated as " European seed ".

b) American seeds which cannot be recognised certainly as coming from North or South America are to be designated " American seeds ".

c) Seeds which are free from those characters which are considered typical of American seeds are to be designated " free from American characters ".

d) Seeds which besides the characters of other origins contain also those of American seeds are to be designated as "containing American characters. "

e) Samples which are recognized without doubt as mixtures of various origins are to be indicated with the observation " containing... "

In the *determinaton of purity* the following are to be separated: earth, sand, stones, chaff, foreign seeds and damaged and shrivelled seeds of the variety in question in so far as these are undoubtedly incapable of germination.

Samples sent in for *examination for dodder* are to be passed through a suitable square-meshed sieve and both those which pass through and those which remain on the sieve are to be examined.

Any sample of clover, timothy or flax containing even only one normally developed dodder seed is to be declared "containing dodder".

The number of seeds of " Kapselseide " and " Grobseide ", as well as the number of seeds of clover dodder in the small-seeded clovers and in timothy, are not to be indicated.

If on the subsequent examination of a parcel of seeds *warranted* as dodder-free or of one sealed by the Seed Control Station, five or more dodder seeds per kilogram (2.2 lbs.) are found, the vendor is bound to take the seeds back again at the request of the purchaser. If less than five seeds per kilo are found, the vendor must bear the cost of another cleaning of the seed.

The seeds for a *germination test* are counted out of an average sample, which is taken at the same time as the sample for the determination of purity.

For the determination of *germination capacity* two parallel sets of

tests are to be made, each with 200 good (" pure ") seeds. For large seeds (maize, beans, acorns, etc.) usually two sets of 100 each are sufficient.

Several kinds of seeds are steeped before being put in the germinator.

As germinating bed, filter paper, pure quartz sand and sterilized porcelain dishes are allowed. The moisture must not exceed 70 per cent. with filter paper and 20 per cent. with sand. Otherwise the optimum moisture depends upon the kind of seed and the germinating medium. The choice of the germinating bed depends upon the kind of seed to be tested.

The paper germinating bed must consist of several sheets of sufficiently thick and absorbent filter paper laid over each other and so arranged as to admit the necessary access of air.

The daily amount of water is to be given by sprinkling the lowest sheets of paper from a wash-bottle specially arranged for the purpose, never directly onto the seeds.

The sand germinating bed, besides being used for beet seeds, is sometimes used also for the control of the experiments made with filter-paper on lupins, sainfoin, peas, beans and cereals. It is made by mixing clean river sand with spring water, the quantity (1) of which is determined by the size of the grains of sand (2). The wet sand is placed in a suitable glass dish, then pressed with a marker which makes 100 small holes, in which the selected beet clusters are placed; the whole is then covered with a glass plate and glass cover.

The germinating beds, both paper and sand, containing the seeds are then put in the Weinzierl germinating case, the former on strips of glass, the latter on wooden laths, where the seeds that require it are submitted to intermittent temperature. Such are *Agrostis alba*, *A. vulgaris*, *Aira caespitosa*, *Alnus*, *Alopecurus*, *Anthoxanthum*, *Avena flavescens*, *Dactylis*, *Beta*, *Betula*, *Daucus*, *Glyceria*, *Holcus*, *Nicotiana*, *Phalaris arundinacea*, *Pinus Strobus*, *Poa* sp., *Zea* ; these are kept for about 10 hours at 18° C. and for 14 hours at 28° C. All other seeds are placed in an unheated germinating case at room temperature (15° C. or 20° C.).

In every germinating case with paper beds, care must be taken to provide fresh air, but this must be as moist as possible ; it is best obtained by placing a tin vessel full of water on the heated bottom, and ventilating daily.

If gas heating is employed, Weinzierl's safety burner is useful; with electric heating, the best is a heater let into the bottom of the germinating case. The temperature must be regulated by reliable automatic regulators.

Whilst, as a rule, germination trials are carried on in the dark, parallel tests in diffused daylight are recommended for *Poa* spp., *Dactylis*, *Phacelia* (these require also a lower temperature, 15° C.), *Larix europea*, *Pinus sylvestris*, *P. maritima*, *P. Strobus*, *Alnus* spp. and *Betula* spp.

(1) 400 cubic centimetres.
(2) 0.25 to 0.5 millimetre.

The most favourable result (if superior to the " dark " test) is to be taken as the final one.

On the process of germination preliminary communications may be made.

If deviations of more than 10 per cent. between the parallel tests are observed, the test must be immediately repeated with 2 × 200 grains. In the case of cereals, lupins, sainfoin, peas and beans this is to be carried out with sand beds.

The number of sprouted seeds referred to 100 gives the percentage of germination. In the case of lucerne one-half of the hard seeds, and for the other clover seeds one third, has to be added to the number of sprouted seeds ; but the actual results must also be given.

For forest seeds, on conclusion of the test the number of seeds that have not germinated but are fresh is to be specially mentioned in the report. For *Abies*, *Acer*, *Carpinus* and *Fraxinus* only the section test is practised.

Limits of error (1).

1. For the practical value: 5 per cent.
2. For beet seeds the following rules are to be observed:

If a second examination of the same beet seed shows differences in some properties and these differences lie withim the limits of error of analysis, the two results are to be considered as agreeing with eaeh other.

The limits of error of analysis are the following:

1. In water content	1 per cent
2. In the content in foreign matter and in the imperfetiy developed clusters in results up to 3 per cent.	1 »
3. In the number of clusters per gram 5 per cent. In the germination capacity (seedlings and clusters capable of germination).	10 »

Subsequent control. — The purchaser must send to the Seed Control Station for further examination an average sample of the quantity, taken in the presence of two witnesses and accompanied by the duly filled in guarantee certificate.

The subsequent examination is to be carried out on principle free of charge for the buyer of at least 5 kilos (11 lbs.) of goods from a so-called contract firm (Vertragsfirma).

The fee for the subseqnent examination is paid as a rule by the firm and amounts to 50 per cent. for the normal tariff ; the same is the case also for the purchaser when he offers to bear the expense.

The right of the purchaser to claim compensation ceases :

a) When the sample is not sent in within 8 days from the date on which the goods were received.

(1) The limits of error are considered only for the published final results, while the deviations allowed for the individual determinations are given in the descriptions of the methods of examination.

b) When the claim for compensation has not been made within 8 days of receiving the result of the subsequent examination.

In cases of differences being found, the amount of compensation is calculated on the basis of the guaranteed practical value and that of the goods delivered, and taking into consideration the normal limits of value for all kinds of seeds with the exception of beet seeds, according to the formula:

$$Ab = \frac{Pr}{100 \times Gb} \times V \times Qu, \text{ in which.}$$

Ab = Compensation.
Pr = Price per 100 kg. (220 lbs.).
Gb = Guaranteed practical value.
V = Percentage to be compensated.
Qu = Quantity purchased.

For beet seeds the amount of compensation is arrived at by calculating the so-called value index (Wertzahl according to v. Weinzierl) (1) as the percentage ratio between the value guaranteed and that delivered.

Sealing with leads. — On principle the sealing of sacks is only done in the permanent warehouses of the contract firms. In other places, such as public storehouses, railway premises, etc., it is done only exceptionally and with the consent of the board of the Seed Control Station.

The clover seeds to be sealed must be put in seamless sacks and placed in large stores free from dust, in such a way as to allow of easy access to the officials charged with the sealing.

The sacks must then be closed by passing a needle and twine right through them at the spot where they are to be tied and then tying them round two or three times.

At the ends of the twine a label (Spitzzettel) which bears the same number as its counterfoil (Attest), is first hung and then they are closed with the leaden seal upon which the official dies impress the month and year on one side and on the other the Austrian eagle with the inscription " K. K. Samen-Kontroll-Station in Wien ".

An average sample is taken from different parts of each sack to be sealed and is put into a small, also seamless, bag, which is likewise closed with the Station's seal.

The examination of these samples is performed without exception in the laboratory of the Seed Control Station. The firm is immediately informed of the result and requested to remove the leads and labels from all the sacks about which doubts arise and to send them by return of post to the Station.

As fit to be sealed, the Station considers only those leguminous seeds which have been found on examination to be " dodder-free " (2) and which

(1) Cfr. v. WEINZIERL: Eine Wertzahl für Rübensamen. — *Wiener landw. Zeitung*, 1910, No. 75.

(2) As " dodder-free " seeds to be sealed are considered only those which do not contain one single developed grain of dodder in the average sample taken from them.

present the appearance of being seeds capable of germination that have been cleaned with the best machines. Besides this only such red clover and lucerne seeds are admitted which are evidently not of American origin and contain no admixture of American seeds.

The origin of the clover seeds is not given in the sealing certificate, and consequently a special written guarantee must be demanded from the vendor. An exception is made for those seeds which are recognised as Turkestan lucerne or South European red clover. These are for the present sealed, but on the certificate the origin is given.

In conclusion, and in order to give a clear idea of the whole work of the Vienna Seed Control Station as it is at present, it must be noted that it does not limit itself to the examination and analysis of commercial seeds, but as a natural complement of its control work it carries out field experiments, and scientific research on seed breeding, growing of grass seeds, and on the value of the different varieties of seeds put on the market; it thus acts as an agricultural botany experiment station (1), as is set forth in the second title which the Seed Control Station bears according to its statutes.

The Cattle Industry in Britain

by

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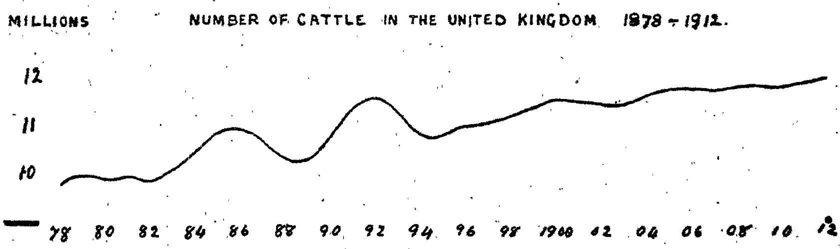
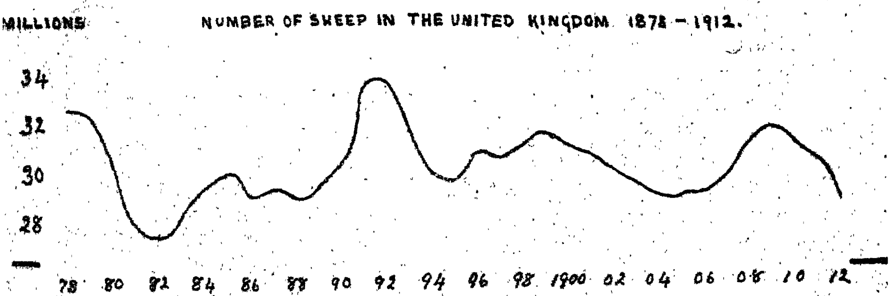
It is impossible accurately to trace the development of the Cattle Industry in Britain throughout any very long period of time, as accurate statistics are available only for the latter part of the previous century and for the present one. The only statistical statement of earlier times on which any amount of reliance can be put, is that of Davenant, published in 1688. Davenant estimated that there were, in England and Wales, four and a half million cattle, twelve million sheep, and two million swine. The population at the time was put, probably with a considerable degree of approximation, at 5 ½ million persons. There are, at the present time, in the same portions of the United Kingdom, about 6 million cattle, 19 ¼ million sheep, and 2 650 000 swine. Cattle have therefore increased, in the 2 ¼ centuries, by about 33 per cent., while the average increase of the three classes of meat-producing animals has been about 43 per cent. During the same period the population has increased about six and a half fold. It is probable that a greater increase in the live stock would be shown, could Scotland and Ireland be taken into account.

(1) "Wirkungskreis und Dienstinstruktion" für die Abteilungen an der k. k. Samen-Kontroll-Station in Wien (approved by Order of the Ministry of Agriculture, No. 1820, 1908). Publ. No. 368.

Since 1878, from which time accurate statistics are available, the number of cattle in the United Kingdom has increased from about 9¾ millions to almost 12 millions. This increase is shown by the accompanying chart (Fig. 1) in which the number is plotted for the 35 years in question.



The fluctuations are somewhat irregular during the first part of the period, but the second part of the curve shows a very steady upward tendency. This increase in numbers, however, has not been in proportion to the growth of the population, for in the same period the latter has increased from about 33 ½ to about 45 ½ millions. Thus an increase of 36 per cent. in the population has been met with one of only 20 per cent. in the head of cattle. At the same time cattle constitute the only group of live stock which have, as it were, made any attempt to meet the growing needs of the population. Fig. 2 shows the variation in the number of sheep during the period mentioned, and it will appear from it that, while there have been somewhat rapid fluctuations in the number of this class of stock, there has been no marked or definite tendency either in one direction or the other.



The National herd of cattle has thus been growing fairly steadily during the last 35 years. At the same time we may trace from the figures of the last 20 years, which are all that are available, a small but interesting change in its composition. The proportion of the whole

returned as "cows or heifers, in milk or in calf", has remained fairly constant throughout, varying between 35.7 and 37.3 per cent., and showing no definite tendency either to increase or to diminish. On the other hand, those grouped as "other cattle, 2 years old and over" have fairly steadily decreased, from 24 per cent. in 1893 to just under 20 per cent. in 1912. There is a corresponding increase in the proportion of yearling cattle and calves, the said increase being about evenly divided between the two groups. It is probable that the change in the cattle industry which these figures illustrate has continued for a much longer period than that for which figures are available, and has, in the mass, been much more extensive than the figures show. There appears to have been a long-continued tendency to market cattle for slaughter at a diminishing age, which has probably lasted throughout a century or more.

It is difficult to decide from statistics what sort of change has occurred in the available supplies of food for cattle. According to the official estimates, there has been a considerable decrease in the national root crop in the past 35 years, from over 2.9 to under 2.6 million tons, or about 13 per cent. On the other hand the total area of pasture and hay increased very considerably up till about 10 years ago, since when however it has shown a tendency to diminish. There has also, without doubt, been a very great increase in the imports of cakes and meals, etc., for cattle feeding, although no statistics are available to show its extent.

The live stock industry of Britain is, of course, insufficient to supply the needs of the home population, whether for meat or for dairy produce or wool. At the same time the home production of meat bears a very much larger proportion to the total consumption than does that of grain. Mr. Rew has recently calculated that the country produces about 55 per cent. of its total requirements of meat, by weight, as against less than 20 per cent. in the case of wheat. Moreover, it is in the case of beef that the home production most nearly approaches the consumption, for while the country as a whole produces slightly under 50 per cent. of its total requirements of pig meat, and only slightly over 50 per cent. of its consumption of mutton and lamb, the total home production of beef is slightly over 60 per cent. of the consumption.

There are sixteen well recognised British breeds of cattle, without counting separately the Lincoln Red and the Dairy sections of the Shorthorn, which have their own special breeders' associations. Of these five (the Ayrshire, Jersey, Guernsey, British Holstein, and Kerry and Dexter) are special dairy breeds, while the others are classed as beef breeds or dual purpose breeds. The latter group includes the Shorthorn (with the two branches already mentioned), the Hereford, Longhorn, Devon, South Devon, Sussex, Black Welsh, West Highland, Galloway, Aberdeen-Angus and Red Poll. The majority of these breeds, whether we consider pedigree herds or ordinary commercial breeding herds, are fairly strictly local, being confined to those parts of the country included in, or adjoining, the counties or districts by which the breeds are named. Others, such as the Aberdeen-Angus, Jersey and Guernsey, while still commonest in their

native districts, are widely distributed over the country generally. The Shorthorn is of course at once the commonest and the most widely distributed breed.

Each of these breeds has a special association of its breeders, which watches over its interests in many different directions. Chief among the activities of these societies is of course the compilation and publication of the herd book. The advantages, as well as the *modus operandi*, of the ordinary system of registration are probably sufficiently well known. Some British herd books are "closed"; that is to say no animal may now be entered in them unless it be the progeny of registered parents on both sides. Others are "open", and accept for registration animals which have a certain minimum proportion of their ancestors registered. The latter system makes it possible for a breeder gradually to render his cattle eligible for registration by the continued use, through three or four generations, of pedigree bulls, and without necessitating the purchase of pedigree females. Some breed societies endeavour to forward the interests of their members by holding special auction sales of stock, and in particular of young bulls. Examples of such sales are those of Herefords at Hereford, of West Highland bulls at Oban, of Devons at Taunton and Exeter, etc. Most of the Societies also offer medals and prizes for their respective breeds at live stock shows, both at home and abroad. Other and various methods of advertisment are employed from time to time.

Most important of the remaining associations in connection with the cattle industry are the milk record societies. Up till ten or twelve years ago Britain was far behind many other countries in the matter of record keeping, but since that time very rapid progress has been made. In the Ayrshire district for example, where the work commenced as late as 1903, there are already 24 societies in existence and in 1912 records were taken of 438 herds, and of 18 356 individual cows. The societies are co-operative, but are supported by grants from the Highland and Agricultural Society of Scotland, the Ayrshire Cattle Society, and now also by Government. Testing, both with regard to quantity of milk and percentage of butter fat, is carried out in each herd about every 21 days. Except in Ireland, where an excellent system of Government assistance to stock breeding has been in force for a considerable time, no extensive grants have been made by Government for the encouragement of cattle breeding. A scheme has however been published in the present year whereby, among others, a grant of £5000 yearly will be available for the purpose of subsidising milk record societies, and one of £13 800 for the provision of pedigree bulls.

Live stock shows have been developed in Britain to an extent which is probably unparallelled in any other country. Besides the large exhibitions held annually by the Royal Agricultural Society of England, the Smithfield Fat Stock Club, the Highland and Agricultural Society of Scotland, the Royal Dublin Society, the Bath and West of England Society, etc., there are innumerable district, county and local shows. Their influence, both in

the direction of encouraging enterprise in breeding and in that of educating the ordinary farmer, has been enormous.

A well-developed system of auction sales also exists, which acts greatly to the benefit of breeders by facilitating the choice of breeding animals. Sales of cattle are held in connection with the Royal and Dublin shows; others are organised, as already mentioned, by breed societies; and other and very large sales of particular breeds are held by private persons or by auction companies. Among the latter, those of Shorthorns and Angus cattle at Perth, and those of Shorthorns at York and Birmingham are the most notable.

There is, as is well known, a large export trade in pedigree cattle from Great Britain. During the five years 1906-10 inclusive the annual exportation averaged 4830 head, and the average value is given at £45 a head. This number, however, includes an average of 1733 exported to the Channel Islands for food, so that the number of breeding animals was 3097 and the average value probably about £60. The United States of America on the one hand, and the republics of Argentina and Uruguay on the other, are by far the largest purchasers. In the period mentioned the former country took 32 per cent., and the latter two 30 per cent., of the total head exported. Canada and British South Africa are the next largest purchasing countries, having taken about 7 per cent. each, while Australia and New Zealand together accounted for about 4 per cent. of the total. Although no figures are available, it is well known that the Shorthorn is the breed which is by much the most numerously represented in the exports, and is that which is most cosmopolitan in its distribution. Herefords are exported in considerable numbers to South America and have, in the past, been taken in large numbers to the United States. Aberdeen Angus, Red Poll, Jersey, Guernsey, Ayrshire, Devon, Sussex and Galloway all play a greater or less part in the export trade, and there is probably no breed which is not occasionally represented.

The export trade has had a very marked tendency to raise the prices of the types of stock taken. The effect of foreign competition may be shown by comparing the prices brought by Shorthorns and Aberdeen Angus, the former of which breeds enjoys a large export trade at present, while the latter is comparatively neglected. At the two largest Shorthorn sales (Perth and Birmingham) some 1100 bulls were sold in the years 1912 and 1913, at the average price of £53. At the corresponding sales of Aberdeen-Angus, about 750 bulls brought an average price of £33.

A somewhat striking feature of the British Cattle Industry, if we compare it with that of other countries, is the extent to which particular districts have specialized in particular branches, for which their special conditions render them suitable. Thus there are districts in which dairying is the only important branch, and others in which rearing or fattening respectively predominate. The result of this is a very large trade both in young store animals and in others ready for fattening, the extent

of which may to some extent be judged from the fact that Great Britain imports from Ireland about half a million stores annually,

As regards systems of management, various methods of rearing are employed. In some regions, as for example the Western Highlands of Scotland, calves are brought up in the natural manner, on their own dams Needless to say this method can be employed for ordinary commercial. stock only on the cheapest class of land, where the cost of maintaining the cow for the year is low. In some cultivated districts a method of rearing is employed whereby the calves are suckled, but where each cow is made to rear two or more calves in the course of her lactation period. An extra calf, or in some cases two, are bought for each cow when she comes into milk and are put on along with the cow's own calf. Later, generally after about 4 months, these are weaned, and one or two others are put on. In this manner many farmers are able to rear an average of three, and in some cases of four, calves on each of their cows. A fairly docile and fairly deep milking stock of cows, as well as careful supervision, are necessary to make this system a success. The commonest method of rearing is however that by which the calves are pail fed, receiving whole milk only during the first few weeks, and being then gradually transferred to skimmed or separated milk with a cream substitute. Various substances are employed in the latter capacity, but crushed linseed and crushed oats or oatmeal are perhaps the most widely used. There are also many proprietary cream substitutes on the market.

There is not much to be said regarding the methods of rearing, from the time of weaning until the animal is ready to be fattened. In summer young cattle are kept at pasture, and rarely receive any additional feeding. In winter they may be kept indoors, generally in covered or partially covered yards, or they may be left outside for the most part, depending on the climate of the district. The winter food consists of roots, hay and straw, with a small quantity of artificial food, often linseed cake in the case of very young animals, generally cotton cake for older ones. The proportions of these materials used to build up the ration vary considerably in different districts. In arable districts, and especially in the north, roots preponderate, while in grazing districts hay constitutes the main part of the ration, or sometimes, as in Ireland, practically the whole.

Fattening is, in summer, carried out for the most past on the grazing system, although sometimes the animals are kept in yards and fed with cut grass, vetches, etc. Some pastures are capable of fattening cattle without any additional ration, but generally speaking some 4 to 8 lbs. of feeding cake are given, at least during the finishing stages. Winter fattening rations show the same variation as do those for young cattle. In the north-east of Scottland, a typical ration would consist of 100 or 120 lbs. of turnips or swedes, 10-14 lbs. of oat straw and 4-8 lbs. of concentrates. In the eastern districts of England about half the above quantity of roots is employed, with part at least of the fodder in the form of hay, and generally a larger quantity of concentrate. In south-western England and in Ireland, the main part of the ration is hay, with a moderate al-

lowance of cake, and sometimes a small allowance of roots. Fattening cattle are perhaps most frequently kept in lots of 6 to 20 in covered or partially covered yards, but many are also fed in single or double boxes, or tied up in byres. The process of fattening generally lasts from 3 to 6 months, and finished cattle come on the market at anything betwen 15 months and 3 ½ years of age.

Systems of dairy management are many and varied. In cheese-making districts it is generally arranged for the cows to calve in spring, as it is not considered economical to produce any large quantity of cheese during the winter months. The cattle run at pasture in summer, and may receive perhaps 2 or 4 lbs. of concentrate, such as bean meal or cotton cake. In winter they are fed on a rather low ration consisting largely of hay, with perhaps 20 or 30 lbs. of roots and again a little cake or meal. In other districts, where butter or whole milk is sold, the cows are arranged to calve at more or less regular intervals throughout the year, and they are also much more intensively fed throughout the winter.

In the neighbourhood of many large towns, dairy men are frequently not breeders of cattle, and in many cases not even farmers. They purchase freshly calved cows, milk them for a period of ten or twelve months, fattening them in the interval, and sell them for slaughter at the end of this period. The ration consists of cut grass, vetches, etc., in summer, and of roots, hay and straw in winter, with an allowance of 10-15lbs. of cake, and meal or part equivalent of wet brewers' or distillers' grains in either case.

As regards the value of commercial stock, the average price of first quality Shorthorn cows, in milk, is given in the Agricultural Returns at £21 10*s*. for the last five years; and good specimens frequently bring £25, and occasionally over £30. The average price brought for all classes of cows in milk is probably between £17 and £18. Young calves of dairy breeds bring from 10*s* to 30*s*, and those of the larger beef and dual purpose breeds from 30*s* to £3. Two year old store cattle of the Shorthorn, Angus and Hereford breeds are quoted in the official returns at from £12 to £17, and £14 is probably about an average. The mean price of fat cattle for the past five years is given at 35*s* 2*d* per live cwt. (112lbs.), making the probable average price per head about £18.

At the present time, one of the main features of the cattle industry in Britain is the scarcity of stores, or at least the insufficiency of the supply of this class of cattle to meet the demands of feeders. The consequence of this is the high price at present ruling for stores, and the diminution in the profits of feeding. This points to the probability of a further, and possibly more rapid, increase in the national herd in the future.

There is also abundant evidence that more attention is being devoted to the improvement of dairy stock than has been, in the past, directed to this end. This tendency is shown in the very rapid development of milk record societies, as already mentioned, and also in the greatly increased prices that are now being paid for pedigree dairy stock, compared to those ruling a few years ago. The increasing importance of the dairy industry probably to a considerable extent accounts for this tendency.

Recent Experience and Progress in Moor-Cultivation in Germany

by

Geh. Regierungsrat Prof. TACKE, of Bremen.

The investigation of the natural history of moors in general, and of the scientific basis of their agricultural utilization in particular, is arousing interest in ever widening circles. The work of the Institutes specially devoted to moor investigations (Moor-Versuchs-Anstalten), of the Geological Institute of the country and of numerous individual investigators is being successfully directed to the extension of our knowledge of the origin, formation and alterations of the various types of moors from the geological, botanical and chemical standpoints. Remarkable efforts have also been made with the object of obtaining uniform definitions of the terms employed in the study of moors, and a classification of the various peat and moor formations, which however, have not yet led to conclusive results. Of special importance from a practical point of view is the not yet fully settled controversy as to the existence of so-called humic acids, especially in the free form. While on the one hand attempts are made to prove that all the phenomena attributed to reactions or free humic acids, consequently chemical processes, are nothing else than purely colloidal or physical effects, on the other hand the view is held on the strength of extensive researches and experiments that the undeniably colloidal state of humic substances does not by any means exclude the existence of real humic acids and of chemical reactions caused by them.

Extensive researches upon the bacteriological conditions in untouched and cultivated moors allowed striking differences in the kind and number of the existing lower organisms to be recognised, as well as the great effect produced upon them by the various operations of cultivation. Both bacteriological and chemical investigations proved that the very energetic decomposition of nitrogen compounds which under some circumstances takes place in moor soils, to the detriment of the yield, can be of a purely chemical nature. Closely connected with this question is that of the unfavourable effect of heavy liming on sour moor soils and those poor in lime, which in spite of much research has not yet found a satisfactory explanation.

Of practical importance is the result, that the quantity of lime to be added to very acid moor soils lacking in lime, especially when only cereals and hoed crops are grown, must be kept within narrow limits and under 16 cwt. per acre, calculated as calcium oxide. On the other hand, when the same land is put to permanent meadow or pasture, at least twice as much lime should be spread; under certain conditions, especially with deep ploughing, still more is to be given to ensure success. No injury is to be feared here. The explanation of this phenomenon, which at first sight seems striking, is that the permanent flora of every good meadow

and pasture contains a sufficiently large proportion of clover, and this is favoured to such an extent by an abundance of lime that the unfavourable effect of much lime on the other grasses is not only made good but even outbalanced. According to recent experience, much stress is laid on the minute division of the substance used in liming moor and similar soils requiring lime.

Comparative experiments with various potash salts on moors, especially when strong doses are used and on permanent meadows and pastures, seem to show that the concentrated salts are more advantageous than the crude salts.

Crude phosphates, and also such as are of amorphous outer texture (soft earthy phosphates), are recognised unanimously as suitable only for those moor soils which remain very acid even under cultivation.

Among the new nitrogenous manures, the several kinds of nitrates obtained from atmospheric nitrogen have in general proved as advantageous on moor soils as the ni rogenous manures hitherto successfully employed (nitrate of soda and sulphate of ammonia). Nitrate of lime containing nitrites has proved less successful. Cyanamide, when used early enough before sowing, has a greater or less effect on nitrogen-hungry moors according to the state of cultivation of the soil; but the effect is generally little more than half that of the nitrogen in nitrate of soda.

In the practice of moor-cultivation the most important processes and progress are the following:

The improvement of fens rich in lime and nitrogen by the use of Rimpau's system of sand covering for arable land has quite gone out. The chief reasons against it are: the high technical development of meadow and pasture farming on moors of all kinds not treated with sand, the continued favourable economic situation for the disposal of animal products, the scarcity of agricultural labourers and the relatively high amount of labour for sanded arable cultivation (while meadows and pastures require so much less), and lastly the circumstance that the natural economic and personal conditions necessary for the successful execution of the intensive form of farming constituted by sanded moor cultivation are not frequently found.

The development of meadows and pastures on moors of all kinds, which is especially great on the true moors (Hochmoor) which have been less richly endowed by nature with plant food, depends mainly upon the following progress:

1) The recognition that, where water conditions are suitable, permanent grassland can be made to give heavy yields without recourse to the expensive use of sand as covering (fens) or for mixing with the surface (moors).

2) The improved methods of tillage, which induce a better physical condition of the soil, especially for new crops, by the use of more suitable implements (ploughs, harrows and disk harrows worked by animal or mechanical power). Among these, some rollers especially constructed for the work are very important; they compress the soil after it has been

broken down to a good tilth, thus improving its capillarity to the benefit of the forage plants and affording a firmer footing to the stock at pasture. The regular use of heavy rollers has greatly contributed to the present development of pasturing on unsanded moor soil.

3) The extensive use of subsoil drainage in various forms (sod drains, lath, fascine, pole and tile drains with supports of laths, heather and the like under them to prevent sagging).

4) The exhaustive study of grasses on moor soils and of the life history of the most important meadow and pasture plants, which has led to the production of clover and grass mixtures suitable to the most various objects and localities.

The yields of properly laid down moor meadows and pastures are so satisfactory in all respects that they are equal to those of the best natural grasslands (1). By means of instruction on the part of the moor experiment institutions and commissions appointed for the purpose, of numerous model cultivations in which the association for the promotion of moor-cultivation in the German Empire has taken an active part, and of some large widely-known agricultural enterprises of this kind on moors and fens (East Friesian domain moors, Royal Schmolsin Estate), the knowledge of the methods and of the success obtained has spread everywhere and a satisfactory development of moor cultivation is taking place on all sides, especially in the old existing moor centres of north-west Germany.

Owing largely to the interest repeatedly shown by the German Emperor in the transactions on the promotion of moor-cultivation and on home colonisation in the Prussian Economic Council and in the German Council of Agriculture, interest has been satisfactorily awakened in all circles, especially in administrative and parliamentary ones, on the utilisation of the still existing large areas of moorland, especially as a field for colonisation. One effect of this is evidently the recent appropriation of greater means for moor cultivation and moor colonisation, through which some State moors are to be taken in hand and existing colonisation associations are to be assisted. Further, the Prussian agricultural administration has begun to institute special organisations for the object of utilising and cultivating moors (offices for moor and wasteland cultivation in the provinces including much moor), as well as to provide the necessary competent staff of officials by instituting courses on the cultivation of moors at the several institutions (Moor Experiment Station at Bremen, Moor Experiment Farm of the Pomeranian Chamber of Agriculture at Neu-Hammerstein in the Leba moor, Stolp district, Pomerania). The State and the Provinces have already set aside considerable sums, especially in aid of cooperative moor improvements.

(1) *Die Vsrsorgung Deutschlands mit Fleisch und die Kultivierung unsere Moore und Heideböden*, Memoir of the Association for the promotion of moor-cultivation in the German Empire. — *Denkschrift des Ministeriums für Landwirtschaft, Domänen und Forsten über die Moorkultur und Moorbesiedlung in Preussen*, 1912. — *Mitteilungen über die Arbeiten der Moor-Versuchs-Station in Bremen*, Report 5, 1913.

A law for the protection of moors, at present for the province of Hanover, but which it is hoped will be extended to other provinces including moors, is intended to prevent the destruction of valuable moors by the unsuitable extraction of peat.

Of special importance is the profit that the colonisation of the large moor tracts can draw from the progress of moor cultivation. The character of the farms in the new colonies is simple and safe, owing to the success attendant upon meadow and pasture farming on the moors; not only can the colonisation of these waste lands considerably increase the home agricultural output, especially as regards animal produce, but the increase of small and medium-sized farms, such as are especially suitable for moors, represents an increase of the strength of the nation.

Recent Work of the Royal Entomological Station of Hungary

by

J. JABLONOWSKY,

Director of the Station.

I shall describe below the means of control employed by the Station in the course of 1913 against some parasites.

The corn ground beetle (*Zabrus tenebrioides* Goeze, *Z. gibbus* Fb). is in Hungary one of the most injurious insects. Its larvae injure the crops in autumn, attacking the cereal seedlings, and if the winter is mild they continue their ravages up to the beginning of May. In the month of June the insects devour during the night the grains of barley that are still in the milky stage. What steps can be taken to destroy this pest? For the most part, the farmers excavate ditches in autumn or in spring round the infested fields, and this operation satisfies them, though the parasite is not destroyed by it. It has been known for a long time that in our country this insect becomes so injurious not only on account of the succession of the same cereals on the same soil, but also because in innumerable localities in Hungary wheat follows barley or is sown near the stubble of barley. The former practice may be avoided, but the second is often inevitable. Thus it becomes impossible to obtain by the above process any notable result.

In consequence of the experiments made in the autumn of 1912 in the neighbourhood of Nagykáta (at Szentmàrtonkáta, county of Pest), the Entomological Station has found an effective means of control of the corn ground beetle. A large estate of the neighbourhood, on passing into the hands of a new owner, fell into a deplorable condition in consequence of a change in the system of cultivation. The cereals sown in autumn, on an area of 1422 acres, showed before the beginning of winter the "spots" due to the beetle. The spraying of sulphate of nicotine with which we had experimented

the same year (1912) for the destruction of other pests soon produced an unexpectedly successful result: the "spots" that were treated did not spread in the following spring, because the larvae living on the ground had perished. We employed about 2 oz. of sulphate of nicotine and 1 ½ lb. of soft soap dissolved in 10 gallons of water. The spraying is performed with a common knapsack sprayer, and besides the "spots" the healthy plants for about a yard all round them are also treated. The earlier the spraying is done, the more effective is its action and the lower its cost.

The cereal or barley leaf beetle (*Lema melanopus*) is also included among the numerous insect pests of Hungary, but it does not cause injury to barley and oats except sporadically. The insect appears when these cereals, sown in the spring, are still tender, and it attacks their leaves. Nevertheless the mischief becomes serious only when the larvae hatch out of the eggs laid by the females on the leaves of barley and especially on those of oats; they then invade and devour all the leaves. The plants dry before the proper time and yield no seed, and even the haulms which are cut for straw are refused by the live stock, because the larvae, like those of other Criocera, secrete a viscous substance which moistens the surface of their bodies and with which they soil the haulm.

The means of control known in our country was devised about 18 years ago by one of the officials of the Entomological Station, Prof Sajó. It consisted in collecting the insects which appeared at the beginning of spring by means of a net or in spraying with tobacco extract (since 1892 known in Hungary under the name of Thanaton). Nevertheless these means of defence did not spread in our country, the causes being that in general no one attended much to the adult parasite; at most it was noticed in the later years of its ravages, and consequently no one used the nets. On the other hand the nicotine, the active principle of the juice, was not constant; the first tobacco extract, very active, contained 12 to 13 per cent. of nicotine, whilst later this content fell to 4 per cent. and even less. It is therefore not surprising that this insecticide has lost all credit.

In the course of the year 1913, we resumed the practice of catching the insect by means of nets, and instead of using the usual tobacco extract (Thanaton) we employed sulphate of nicotine. The insects were caught on an estate in the commune of Bokszeg (county of Arad). The result of the operation was satisfactory, inasmuch as on the fields where the net had been used the yield was about the average, while on the other areas it was less. It must, however, be mentioned that in 1913 this insect, owing to the rain which fell in May and June, did not commit the havoc it would have done if the weather had been dry and warm.

Spraying produced equally favourable results, though the rains of May and June rendered the work more difficult. The spraying was effected at Csála (near the town of Arad) in one of the State vineyards, using 4 lbs. of nicotine and 15 lbs. of soft soap to 100 gallons of water. A smaller quantity of nicotine was not equally efficient, while on the other hand a quantity greater than 4 lbs. per 100 galls. did not give any better results. The experiment succeeded perfectly, notwithstanding the fact that favourable weather,

that is not rainy, was rather rare. On the spots that were treated the larvae were completely destroyed, whilst where no treatment was applied they continued their depredations and then went through their metamorphosis.

This experiment made with the two systems offers farmers the possibility of controlling the pest in either way without being hindered by unfavourable weather.

Vine Caterpillars. — Similarly, other experiments were conducted on a larger scale with sulphate of nicotine against the caterpillars of *Conchylis ambiguella* and of *Polychrosis botrana*, which in Hungary (especially in the most valuable vineyards on sandy soils) cause as much injury as elsewhere. The experiments were conducted at Kecskemet (county of Pest) in the Miklós nursery (Miklós -Telep National School for Vine growers), and on a larger scale in the vineyard of the Royal Hungarian School of Agriculture at Jaszberény (county of Jasz-Nagykun-Szonok).

As a result of studies continued through a long series of years, the Entomological Station adopted the means of control which had succeeded especially in France, using sprays containing two ounces of nicotine (either sulphate of nicotine or the nicotine of the common extract) and 1 ½ lb. of soft soap to 10 gallons of water, or Dr. Jean Dufour's mixture composed of 1 ½ lb. of pyrethrum powder and 3 lbs. of soft soap to 10 gallons of water. Our system of control was thus similar to that employed elsewhere. As in 1913 the appearance of the larvae of *Conchylis* was reported on May 11, we began spraying ten days later. Instead of the Eclair Vermorel we used a sprayer mounted with an air pump working at a pressure of 4 or 5 atmospheres and provided with a forked rod bearing two nozzles, so that the two powerful cone-shaped jets strike the bunches on opposite sides at the same time. During the work we observed that on the vines treated at first there were still some larvae, while the bunches of the vines treated after the 24th and 25th of May were freed from 98 to 99 per cent. of them. The action of these liquid insecticides was very nearly the same, inasmuch as all the bunches treated either with nicotine or with pyrethrum powder were free from insects. Sometimes, however, the sulphate of nicotine proved the more effective. Between May 24 and June 8 the whole vineyard, about 43 acres, was treated, and there was still time to treat again the first plots (which had been treated between the 19th and the 24th of May) and which the caterpillars had not wholly abandoned. At the time when the vines were in bloom the vineyard was completely freed from caterpillars, which left scarcely any trace of their ravages.

These experiments have thus demonstrated that spraying gives a result of 98 to 99 per cent., provided the following conditions be observed: 1) that the control by means of liquid insecticides be commenced at the most favourable moment for the hatching of the caterpillars (in Hungary in 1913 it was after May 24); 2) that the spraying be carried out under great pressure; 3) that the bunches be sprayed on both sides; 4) that the solutions be composed of insecticidal substances (nicotine and pyrethrum) and of substances capable of removing fat (soap).

A complete destruction of the caterpillars is impossible, as on account of the continued appearance of the moths of *Polychrosis*, some caterpillars hatch out much later, and further the earlier ones do not attack the bunches of grapes but hide under the bark of the young shoots.

The results obtained by the experiments having been striking, our next task will consist in spreading the above method of destruction among the vine growers of the country.

Grape moth. — Among the other enemies of the vine we undertook experiments on a large scale against the caterpillars of the grape moth (*Tortrix pilleriana*). These caterpillars cause enormous injury, not only in the old vineyards of the mountainous districts and in those previously ravaged (as for instance at Versecz, county of Temes), but also in the vineyards on sandy soils, and the havoc caused reminds us of the times when they seriously threatened the French vineyards. In our country, in some vineyards, for instance at Sóstóhegy (near the town of Nyiregyháza, county of Szabolcs), where we carried out our largest experiments, the vine stocks after having been injured for three years in succession did not bear anything but slender shoots. Our experiments consisted partly in the destruction of the caterpillar at the beginning of spring, that is during the time in which the small caterpillar is still in the oldest part of the vine stock, and partly in control practised after burgeoning, when the caterpillar ascends on the shoots. The treatment before the shoots appeared proved completely inefficient. The two well-known processes of scalding and fumigating with sulphurous vapours were not employed. After the appearance of the shoots we had recourse to the treatment with tobacco juice until the caterpillars retreated to the extremity of the shoots, without however obtaining any encouraging results, the solution being unable to reach the caterpillar among the leaves. Instead of this treatment, we picked off the caterpillars by hand, nipping of the young shoots on which the caterpillars were crowded and collecting many of those scattered on the plants. Nevertheless the result was not complete. Although 150 or 200 caterpillars per vine had been collected, those on the ground or on the green hedge soon betook themselves to the vines that had been freed. In order to get rid of these we used a Bordeaux mixture to which half a pound of arsenate of lead had been added to every 10 gallons of liquid. We do not yet know what effect this treatment will have. In 1913 the result was not decisive.

Cockchafers. — The means of control used against the cockchafer (*Polyphylla fullo*) in the commune of Csongrád (county of Csongrád) have not yielded any decisive results. The larvae of this insect cause such havoc in the vineyards on sandy and very dry soils that not only are numerous old vineyards completely destroyed, but their reconstitution is rendered impossible because the larvae destroy the newly planted stocks. In order to control this pest the commune of Csongrád decided to have the insects picked by hand and to pay for them. Unfortunately in 1913 during harvest time the insect did not appear. It is not known if the extraordinarily cold weather and continued rain of 1913 was the cause of this, or if the insects did not swarm at all this year. Nevertheless, on grubbing in the sand, larvae

large and small were found, but no pupae or adult insects. At Kecskemét (county of Pest), situated near Csongrád, both larvae and insects were unearthed and swarming took place. The several thousands of insects that were picked have shown how future control is to be organized. Knowing the preference of this chafer for Scots pine (*Pinus sylvestris*), Corsican pine (*P. Laricio*), Austrian pine (*P. austriaca*) and black spruce (*Picea nigra*), I caused a railway-truckload of large pine branches to be brought from the Szeged pine forests and planted them in the sand of the Csongrád vineyards so that the needles remained fresh for some time. The great majority of the cockchafers were picked from these branches. It is therefore advisable henceforward to plant a greater number of these trees in our vineyards and to collect these insects regularly. This process will be easier and cheaper than picking them off fruit trees and poplars 50 or 60 feet high.

Rodents. — The diffusion of the means of control against rodents was another great undertaking. The Entomological Station, which deals also with the destruction of mammals injurious to fields and gardens, aims at rendering the control of voles, hamster rats and susliks (*Spermophilus citellus*) compulsory by law, and proposes: 1) that the operations of control be carried out every spring (from the middle of March to the middle of April), when the numbers of the vermin are not yet large, and agricultural labourers can dispose of the necessary time; 2) that against voles, flooding, traps (Hohenheim type) and carbon disulphide (5 grams per burrow) be used; 3) that against susliks, 20 grams be used and against hamsters, 30 grams.

In the spring of 1913 the small commune of Kopesény (county of Moson) began the obligatory control; it was followed by the county of Szepes, and 5 communes of the county of Bereg on both banks of the Latorcza, in the control of susliks and hamsters. In these localities hamsters had for several years done much mischief in the maize and other grain fields, there being 40 to 60 burrows per acre. At first the small owners were sceptical as to the efficiency of carbon disulphide, but when after the second and third day of the treatment they observed that the hamster and suslik burrows remained closed and that on opening them only dead animals were found, all diffidence disappeared and they worked with zeal and care. It is very urgent to spread this method of control, especially against hamsters, which are extending and causing much injury in the communes of Sopron county, on the Austrian frontier.

Lime-sulphur mixture. — Lastly it must be mentioned that during the winter 1912-13 the Entomological Station occupied itself with propaganda for the use of lime-sulphur mixture, which is beginning to be known in Hungary. Notwithstanding the fact that this preparation is very effective against *Lecanium*, its spread in our country cannot be very rapid, because: 1) its preparation is lengthy; 2) it does not always succeed on account of the varying nature of the different quicklimes of the country; 3) its preparation is not carried out on a large scale in Hungary nor at a low price. On the contrary the practice of spraying fruit trees in winter with carbolineum (15 lbs. of carbolineum to 10 gallons of water) is constantly gaining ground.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

195 — **The Development of Agriculture in the German Colonies.** — WARBURG, O. in *Der Tropenpflanzer*, Year 18, No. 1, pp. 1-25. Berlin, January 1914.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

The writer points out the increase in the exportation of agricultural produce from the German colonies during the last two years (1910-1912).

TABLE I. — *German East Africa.*

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Sisal	7 114	16 810	147 600	360 700
Plantation rubber	406	1 036	161 300	300 950
Cotton	613	1 852	36 800	102 900
Coffee	980	1 551	41 050	93 250
Copra	5 254	4 174	93 500	76 600
Groundnuts	3 050	5 983	29 200	62 400
Sesame	802	1 852	11 800	25 600
Total	18 219	33 258	521 250	1 022 400

With the exception of copra, all the exports have increased, some even in enormous proportions (cotton 302 per cent.).

TABLE II. — *Kamerun.*

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Plantation rubber	—	24	—	8 400
Elaeis kernels	13 473	15 737	174 100	215 900
Palm oil	3 091	3 538	61 750	81 450
Cacao	3 377	4 479	149 700	207 850
Total	19 941	23 778	385 550	513 600

Plantation rubber makes its appearance. The writer remarks that wild rubber has been badly hit by the present crisis.

TABLE III. — *Togo.*

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Elaeis kernels	8 071	11 455	99 670	165 600
Palm oil	2 971	3 284	60 420	69 250
Cotton	463	542	22 350	25 250
Rubber	133	163	56 200	47 800
Maize	3 340	1 343	14 210	11 300
Copra	134	160	2 000	3 000
Cacao	135	279	4 700	11 900
Total	15 247	17 226	259 550	334 100

Maize is the only crop not showing an increase in exports.

TABLE IV. — *New Guinea.*
(Including the Bismarck Archipelago and the Solomon Isles).

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Copra	9 094	11 193	148 800	198 550
Rubber	6	21	3 300	7 650
Cacao	39	73	2 700	3 700
Sisal	—	21	—	500
Total	9 139	11 308	154 800	210 400

The exports of the above four staples have increased, but only copra has real importance.

From the other islands of German Oceania agricultural exports have risen from £234 900 to £342 000.

On the whole, during the last two years agricultural exports have increased 25 per cent. in weight and 53 per cent in value.

With the progress of agriculture the spontaneous products diminish: wild rubber, copal, tannin and ivory. On the other hand, in Kamerun, kola nuts and karité are on the increase, as shown by the following figures:

	Quantity — tons		Value — £	
	1910	1912	1910	1912
Kola nuts	54	234	880	8 180
Karité	66	105	250	640

The writer shows what progress has been accomplished by native farming. Out of the 54 000 acres planted to cotton in German East Africa, 38 500 acres were cultivated by natives. The progress achieved by German African cotton is mainly due to two causes: 1) the erection of ginning stations (37 in East Africa and 12 in Togo), principally by the "Kolonial-Wirtschaftlichen Komitee"; 2) the institution of experiment stations for the study of diseases, methods of farming and varieties.

Among the oil seeds, besides sesame and groundnuts, the cultivation of which is developing, castor oil is grown in coconut plantations until the latter are in bearing, and it seems to give good results.

During the last few years, farming by Europeans has developed to an extraordinary degree. The chief plants grown are oil palms, tobacco and bananas.

The cultivation of oil palm has advanced thanks to the introduction of new methods, which allow four or five tons of fruit per day to be treated by only 16 or 20 hands, and the fat thus obtained is superior to that formerly produced.

At the end of this year there will be about 2 500 acres of bananas in East Africa, and steamers calculated to carry 50 000 bunches will ensure the rapid transport from Tiko to Hamburg.

The most interesting of recently introduced crops in Kamerun is tobacco. Some experiments have produced leaves for wrappers worth upwards of 3*s* 6*d* per lb. on the Bremen market, and some powerful companies have been formed. It must not, however, be forgotten that Kamerun planters will be in a state of inferiority to those of Sumatra as regards both transport and labour.

EDUCATION
D EXPERI-
ITATION IN
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FORESTRY.

196 – **Grants for Agricultural Education and Research in England and Wales in the Year 1912-13.** (1). — *Board of Agriculture and Fisheries, Annual Report on the Distribution of Grants for Agricultural Education and Research in the Year* 1912-1913, pp. XXV + 132. London, 1913.

This report on the distribution of grants in aid of agricultural education and research gives first some information on the present organization of agricultural education in England and Wales (2). Then follow lists of the grants awarded to the various institutions, with indications as to the kind of work for which a grant is made, and of the grants awarded for the provision of technical advice for farmers and the investigation of local problems, as well as those for building and for miscellaneous purposes sanctioned by the Treasury from the Development Fund up to 31st March 1913.

The amounts are given below:

Grants in aid of Universities and University Colleges	£	10 000
" " " " Agricultural Colleges	"	6 050
" " " " Special Institutions	"	2 800
" " " " Farm Schools	"	290
" " " " Agricultural Research Institutes	"	6 434
" " " " agricultural research and experiments	"	3 008
" for the provision of technical advice for farmers and the investigation of local problems	"	1 568
Total	£	30 150

Grants for buildings and for miscellaneour purposes from the Development Fund amount to £ 62 495.

The report contains also information on certain institutions in receipt of grants, notes on work at research institutes, research scholarships in agricultural science in the years 1911-12, the staffs of Universities and Agricultural Colleges in receipt of grants and the number of students (altogether 1165) attending course at Universities and University and Agricultural Colleges in receipt of grants, besides communications upon the organization of local schemes of agricultural education and advisory councils.

ICULTURAL
HOWS AND
NGRESSES.

197. – **Agricultural Shows.**

Australia.

1914. May 6 (opens). Hobart. — Inter-state fruit exhibition.

Aug. 11-16 Brisbane. — National exhibition.

Austria.

1914. May 16-21 Prague. — Annual Bohemian Agricultural Exhibition.

Sept. 7-12. Göritz. — Vine-growing and wine-making show, held on the occasion of the 9th Austrian Oenological Congress.

Dutch East Indies.

1914. Sept. 8-Oct 10. Batavia. — International rubber show.

(1) For 1911-12, see No. 452, *B.* May 1913. (*Ed.*).

(2) See No. 1018, *B.* Sept. 1913. (*Ed.*).

France.

1914. April 1-5. Nantes. — Poultry show organized by the "Syndicat des Aviculteurs de l'Ouest".

May. Epernay. — Agricultural, horticultural and vine-growing show, organized by the " Union agricole, horticole et viticole de la Marne ".

Oct 24-28. Cette — Federal horticultural show, organized by the "Federation horticole du Littoral'" (Hérault, Gard, Vaucluse, Bouches-du-Rhône).

Germany.

1914. May 15-21. Altona.—Great exhibition of horticulture, fruit and vegetables, organized by the city of Altona in commemoration of the 250 th anniversary of its foundation. Address to the Committee, 75 Flottbecker Chaussee, Altona.

Holland.

1914. July. The Hague. — Horse show. Sec. A. v. Hoboken, Nieuwe School-straat 27, The Hague.

Hungary.

1914. April 4-6. Budapest, Tattersall. — Thirtieth sale of breeding stock and show of agricultural machines and implements, organized by the National Agricultural Society of Hungary.

Russia.

1914. Governments of Kiev and Taurida. — Competition for agricultural machines. Reduced rates on Russian railways and free entry for machines taking part.

Spain.

1914. Autumn. Madrid. — International exhibition of agriculture and hygiene.

United Kingdom.

1914. May 19-21. London, Chelsea. — Royal Horticultural Society's spring show, at the Royal Hospital Gardens.

May 28-30 and June 1-2. Swansea. — Bath and West and Southern Counties Society's show. Sec. Thos. Plowman, 3 Pierrepont St., Bath.

June 10-13. Portsmouth, Southsea Common. — Royal Counties Agricultural Society's show. Sec. Franklin Simmons, Basingstoke.

June 30. - July 2. London, Kensington. — Royal Horticultural Society's summer show.

198. - **Agricultural Congresses.**

Dutch East Indies.

1914. Sept 7-12. Batavia. — International rubber congress.

France.

1914. July 20-22. Lyons. — International Vine-growing Congress, arranged by the vine-growers' society of the Lyons district in conjunction with the Permanent International Commission on Vine growing. The chief question will be vine mildew (*Plasmopara*).

CROPS AND CULTIVATION.

199 - **Distribution of Drought.** — *Communication from Professor* FILIPPO EREDIA, *of the Central Bureau of Meteorology and Geodynamics, Rome.* AGRICULTURAL METEOROLOGY.

In Russia Professor Broounoff has been the means of starting studies on the effect of meteorological factors on the crops. The interesting results which he has obtained are such as to favour the general adoption of the Russian methods, especially in countries such as Italy where meteorological researches for the benefit of agriculture have been little followed.

As these methods are based on the climatic individuality of a particular region, their application necessitates a very thorough understanding of the climatic conditions, and quite possibly the methods may require alteration in certain details to make them of more value.

There exists for each plant what is known as the critical period, during which certain meteorological conditions are required. Plants should be adapted in such a way that they have their growing periods at a time when meteorological conditions are favourabale. A knowledge of the distribution of rainfall during short periods, of, say, ten days, considerably facilitates the choice of plants suitable for any given climate, but is not sufficient, since one cannot deduct from average data any conclusions as to the irregularities of the rainfall. Prof. Broounoff thinks that charts representing the distribution of drought would be useful in this respect, and he suggests for this purpose the term " dry ten-day periods ", by which he understands periods of ten days during which the total rainfall does not exceed 5 mm. (0.2 in.)

Charts of this kind already exist in Russia, based on rainfall data accumulated during at least 16 years and determinations of the frequency of drought of a certain ten-day period during a given number of years. By means of these values, reduced to one hundred years, Prof. Broounoff has arranged his charts so as to show the probability of the occurrence of drought. It is evident that these will be of the highest value in the parts of the year when rainfall is least ; but it is probable that what constitutes a dry ten-day period may need modification, since in certain regions where rain is absent during several months, the idea of drought would not appear to correspond to that which has guided Prof. Broounoff. This is the case in various parts of Italy, particularly in Sicily, where there are distinct rainy and dry seasons, though the rainy season often contains periods of drought or low rainfall. There is no doubt as to the value of knowing the minimum rainfall which will probably take place during a given ten-day period in any given locality, but I believe that more useful inferences could be drawn if the idea of a dry ten-day period could be replaced by a notation showing more clearly the occurrence of rain.

An examination of the ten-day periods with a total rainfall of 5 mm. (0.2 in.) shows that different values must be attached to them, according to the time of the year at which they occur ; that is to say, during periods of regular rainfall a ten-day period with a total of 5 mm. is really a dry period comparable to one having no influence on vegetation, whilst, on the other hand, if it occurred in a period of extreme dryness, *e. g.* during the summer months in Sicily, such a period could exercise considerable influence. It would appear, therefore, that the rainfall measurements would be more profitable if the probability of the period with low rainfall greater than 5 mm. were known, and also those of absolute drought. In the various observatories in Sicily, observations of the rainfall have been made during a considerable period, and it may be seen to what extent the ideas expressed above are of value for these regions.

		Frequency of ten-day periods with rainfall between 0.1 and 5 mm.											Frequency of ten-day periods without rain										
		Trapani	Palermo	Messina	Riposto	Catania	Siracusa	Mineo	Sortino	Giarratana	Caltanis-setta	Girgenti	Trapani	Palermo	Messina	Riposto	Catania	Siracusa	Mineo	Sortino	Giarratana	Caltanis-setta	Girgenti
September	1st	17	25	27	25	37	6	16	13	4	19	21	63	50	33	50	43	53	44	53	54	42	61
	2nd	23	32	30	12	13	16	16	23	12	23	17	30	22	10	31	40	31	32	33	38	38	52
	3rd	20	16	20	6	23	25	8	23	12	31	21	10	9	10	25	17	12	28	30	23	15	21
October	1st	23	19	13	31	19	25	16	17	7	18	28	10	0	3	16	13	6	32	28	18	11	7
	2nd	10	12	17	12	26	28	12	10	7	7	27	3	0	3	6	10	6	8	17	14	21	7
	3rd	13	12	3	34	26	22	20	14	14	11	14	7	3	3	9	13	6	16	10	14	18	17
November	1st	10	12	10	9	13	22	16	10	3	14	27	3	0	3	19	16	6	8	14	17	0	7
	2nd	23	9	7	12	10	22	16	23	7	7	7	7	3	0	16	3	12	12	3	14	7	10
	3rd	13	0	10	16	10	19	12	10	10	11	10	3	6	3	9	19	9	12	7	10	7	10
December	1st	13	6	3	16	16	9	8	7	7	22	4	0	0	0	9	6	9	0	10	3	0	4
	2nd	10	0	0	6	19	16	8	20	7	19	23	3	6	0	16	13	9	12	7	21	4	10
	3rd	7	12	0	31	26	19	8	10	3	19	7	0	0	0	0	10	3	4	3	0	4	4
January	1st	10	6	11	16	19	16	20	16	10	15	20	0	0	0	12	6	3	0	10	14	0	0
	2nd	13	3	4	16	13	12	14	13	17	22	21	3	3	7	9	16	9	8	7	7	0	14
	3r	10	19	7	19	16	19	16	16	7	12	14	7	3	7	6	10	3	8	3	10	4	10
February	1st	10	3	4	12	23	16	24	23	4	11	24	10	6	7	19	13	9	8	10	10	14	4
	2nd	27	6	0	9	16	19	12	10	21	18	21	3	3	7	9	6	3	8	7	7	0	14
	3rd	27	16	14	22	29	25	16	20	11	25	17	10	6	7	25	10	16	16	7	21	7	10
March	1st	23	3	3	9	42	28	20	30	17	13	17	7	6	0	22	6	6	8	7	4	13	7
	2nd	20	9	20	12	36	25	20	23	17	21	13	13	12	10	22	6	28	16	20	31	13	13
	3rd	23	12	7	16	26	34	24	23	9	31	10	7	3	0	22	16	9	4	13	24	17	20
April	1st	33	25	23	31	29	31	16	20	14	31	23	7	6	3	6	19	25	16	16	14	7	17
	2nd	20	19	17	19	32	44	32	27	10	29	27	13	0	3	28	10	12	4	16	21	14	17
	3rd	37	19	23	16	23	34	28	30	7	32	23	10	0	3	31	23	19	24	16	28	7	13
May	1st	23	34	27	28	39	44	44	38	26	34	40	17	6	7	31	26	31	24	28	30	25	33
	2nd	47	31	27	22	23	25	20	17	22	21	27	27	19	27	44	36	34	36	48	44	31	40
	3rd	30	19	10	16	19	16	24	14	11	33	27	33	22	20	34	23	34	24	31	30	13	37

The first part of the table given here contains numbers expressing the frequency during the period of observation of ten-day periods with not more than 5 mm. rainfall, reduced to a percentage number of years. Since the rainy season lasts from September to April and sometimes to May, we omit the indications relative to June, July and August.

In the first ten-days of January, the frequency of rainfall from 0.1 to 5 mm. is higher for the east and south slopes, the Tyrrhenian slope and centre showing only one half the figure. In the second ten-days the frequency is higher in the centre and the south slope and still continues high on the east side, while it is less on the Tyrrhenian side. The extreme west presents a higher frequency and is distinct from the conditions shown for the Tyrrhenian slope. In the third ten-days, the differences above indicated are much less, only very small local perculiarities being noticeable. During the three ten-day periods of February, the Tyrrhenian slope shows a minimum frequency in comparison with that of the other slopes, and the extreme west gradually approaches the conditions peculiar to the eastern slope, where on the contrary we meet with a higher frequency. The same conditions hold good for March, when, however, the centre and the lower part of the east slope show a higher frequency; the interior and the extreme west come next in this respect, then the eastern and Tyrrhenian slopes. In April and May the frequencies are little different, except for the lesser frequency in the interior of the Syracuse region and on the upper eastern slope.

In September the frequency is greater for the Tyrrhenian slope and the middle and upper eastern slope, while elsewhere, especially in the interior of the Syracuse region, the frequency is less. In October the frequency becomes higher on the east and south slopes, and diminishes on the Tyrrhenian slope, in the Messina district and in the interior. This difference becomes less in November and December.

We have then various peculiarities appearing. The eastern slope has the greatest frequency of ten-day periods with a rainfall from 0.1 to 5 mm. in its central part, except in November, when on the contrary the greater frequency occurs in the lower part, whereas in the upper part the frequency is reduced in March. The Tyrrhenian slope, which may be made to include Messina, has in September a frequency approaching or slightly exceeding that of the eastern slope, while from October to March it remains lower. The central regions show conditions similar to those of the eastern slope in September; then they acquire the characteristics of the Tyrrhenian slope, losing them again in January. Finally, the southern slope follows the eastern slope from September to February and in March follows the Tyrrhenian slope.

In my opinion droughts in Sicily are best defined by the ten-day periods with complete absence of rain, and I believe that the frequency of these gives a better conception of the idea of drought expressed by M. Broounoff, especially as during the months of the rainy season a ten-day period with 5 mm. or less rainfall may be of some use to the crops, since the soil is already damp, whilst in the season of least rainfall such

quantities disappear without being of any use to the crops. Consequently, it would be of use to know the number of dry ten-day periods likely to occur, especially during the rainy season. For this reason the number of times each ten-day period has been dry has been given in the second part of the accompanying table, calculated on a hundred years. The first glance is sufficient to show the radical difference which manifests itself between the different slopes. From the first ten-days of October to the first of January, the Tyrrhenian slope appears very different from the eastern, for absence of rain has not been recorded or has been so rare that in the reduction to percentages it has been found impossible to express it by a value approaching unity. In the two other ten-day periods of January there is some slight correspondence, but the frequency on the east slope is greater and persists. The coastal regions and those of the eastern slope follow the conditions of the Tyrrhenian slope in December, but gradually this order approaches the conditions presented by the eastern slope.

It follows from what has been said that the character of the rainfall is better seen when to the figures for each ten-day period are added those defining the frequency of total rainfall between 0.1 and 5 mm. and of no rain at all.

It would certainly be useful to know the frequency of ten-day periods with a rainfall of from 5 to 10 mm. and also from 10 to 15 mm., since it is the minimum which decides the success or otherwise of the crop.

A conclusion which deserves consideration is that the farmers should know not only the mean quantity of rain, but also the frequency of the different quantities of rainfall for each ten-day period, if they are to derive from it the facts of fundamental value, since the quantity indicated each month has, by itself, only a limited importance.

200 - **On Seasons and Crops in the East of England.** — SHAW, W. N. (Meteorological Office, London) in *Journal of the Scottish Meteorological Society*, Vol. XVI, No. 30, pp. 179-183. Edinburgh, 1913.

A diagrammatic analysis of Mr. R. H. Hooker's paper « Correlation of the Weather and Crops ", which appeared in the *Journal of the Royal Statistical Society* (Vol. LXX, pp. 1-51) in 1907. The diagrams present in a graphic form the extent of the correlation between the abnormalities of the crop and the abnormalities of rainfall and temperature, not only during the year in which the crop was actually grown but also during the preceding year.

The following conclusions are drawn as a result of the investigation: *wheat barley, oats* and *beans* all give the highest returns when the spring and early summer are moist and cool following on a warm midwinter, but while oats are unaffected by the character of the previous season, wheat, and to a less degree barley, are favoured by warmth and dryness in the preceding year, a dry autumn being specially important for wheat. Beans are less influenced by the temperature, but require a low rainfall in the summer and autumn of the previous year. *Peas* appear not to be dependent on abnormalities in the season.

Potatoes are exceptional in being favoured by cold and wet in the previous summer and autumn, and do best in a fine, warm growing season,

while *swedes* are favoured by a continuous abnormally low temperature lasting from the previous summer to the end of the growing season, and by rain in the early summer; *mangolds* require plenty of rain and cool weather in the early spring of the crop year.

Lastly, *hay* shows a striking preference for cool, wet weather in the harvest year, with a period of heavy rainfall in the middle of spring.

201 - **Correlation between Meteorological Conditions and Crops in the East of Scotland.** — WATT, A. in *Journal of the Scottish Meteorological Society*, Vol. XVI, No. 30, pp. 184-187. Edinburgh, 1913.

This article gives the coefficients of correlation between the yearly yields of potatoes and oats in Forfarshire (from the official statistics) and the monthly rainfall and temperature f r the 26 years from 1886 to 1911. For oats, the coefficients of correlation between yield and rainfall are not significant, while a cool summer is distinctly favourable to the crop. The figures indicate that the largest yields of potatoes are obtained in hot, dry summers, low rainfall being particularly important.

202 - **The Composition of Rainwater Collected in the Hebrides and in Iceland.** — MILLER, N. H. J. (Rothamsted Experiment Station) in *Journal of the Scottish Meteorological Society*, Vol. XVI, No. 30, pp. 141-158. Edinburgh, 1913.

A historical sketch of observations on the composition and properties of rainwater and dew from early times, and an account of recent investigations on the nitrogen and chlorine content of rainwater collected at one point in Iceland, at one point in the West of Scotland, and at three points in the Hebrides lying to the north-west of Scottland — points remote from towns and having a very moist climate.

The amounts of ammonia, nitrate, and chlorine annually brought down by the rain are given below, together with analogous figures taken from the Rothamsted records.

	Rainfall inches	Lbs. per acre			
		Nitrogen			Chlorine
		As ammonia	As nitrate	Total	
Rothamsted	28.8	2.774	1.251	4.025	15.7
Vifilsstadir (Iceland)	38.3	0.802	0.263	1.065	(52.2)
Laudale (W. of. Scotland) . . .	76.9	2.784	1.260	4.044	168.5
Butt of Lewis (Hebrides). . . .	40.6	0.361	0.305	0.666	6 884.0
Monach » . . .	47.2	1.260	0.588	1.848	2 723.0
Barrahead » . . .	33.9	1.164	1.104	2.268	5 753.0

203 - **Rainfall as a Determinant of Soil Moisture.** — SHREVE, F. (The Desert Laboratory, Tucson, Arizona) in *The Plant World*, Vol. XVII, No. 1, pp. 9-26. Baltimore, Md., January 1914.

The influence of rainfall upon the distribution and seasonal activities of plants is obviously exerted chiefly through its power to replenish the

moisture of the soil. The desert regions of North America are characterised by a low rainfall which is chiefly made up of a large number of light rains and a small number of torrential rains accompanied by a heavy run-off. Thus in investigating the relation of rainfall to soil moisture in desert regions, it is necessary to determine the minimum amount of precipitation required to influence the soil moisture, and also to determine the durations of periods without significant rain in connection with the development of vegetation.

The present paper presents a digest of a short record of desert rainfall from Tucson, Arizona, interpreted in terms of its possible effect upon soil moisture; gives data showing the annual march of water content at three depths (3, 15 and 30 cm.) in a retentive clay soil; indicates the relative potency which different falls of rain were found to have in renewing the store of soil water; and estimates the relative efficiencies of various percentages of soil water for the maintenance of plant activity by correlating them with the current rates of aerial evaporation.

The average annual rainfall at the Desert Laboratory is 14.60 in., distributed in two rainy seasons of which the summer one lasting 63 days accounts for 54 per cent. of the annual precipitation. The average number of rainy days is 61.5 per annum, on 46.2 of which the rainfall is less than 0.25 in. In six years there were 32 days with more than 0.75 in. of rain, and they yielded 46 per cent. of the total rainfall in the six years. Finally, there have been periods of 140 days without rainfall of sufficient amount (0.15 in.) to affect the soil moisture.

The march of soil moisture during the year is closely related to the amounts of the significant falls of rain, the changes of moisture content being less transitive at the lower depths (15 cm. and 30 cm.) in the heavy clay soil investigated. The moisture at 3 cm. falls as low as 1 per cent., and that at 30 cm. rises to as much as 32 per cent. The average moisture of the soil from the surface to 30 cm. in the driest weeks of the year is 6.5 per cent., while in the wettest it is 29 per cent. At its minimum water content, the clay soil contains about one fourteenth of the annual supply of water furnished by the normal rainfall.

The weekly rate of atmospheric evaporation ranges from a minimum of 173 cc. to a maximum of 1084 cc. (the annual total being 31 447 cc.) in terms of loss from a porous cup atmometer. This is equivalent to a loss of 345 cc. per square centimetre from a free water surface. The ratio of evaporation to rainfall is as 9.3 to 1.

The ratio of evaporation to soil moisture fluctuates from a minimum to a maximum which are in the proportion of 1 to 10. At the foot of the Santa Catalina Mountains (3000 ft.), it is 9.7 times as large as at their summit (8000 ft.). The annual amplitude of moisture conditions at the Desert Laboratory is as great, therefore, as that which exists in the most arid portion of the year between localities which are 5000 vertical feet apart.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

204 - **Selective Adsorption by Soils.** — PARKER, E. G. (Bureau of Soils) in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 179-188. Washington, D. C., December 10, 1913.

All phenomena connected with absorption are of the first importance in soil chemistry; of these phenomena, while simple absorptive processes have been the subject of a considerable amount of research, such is not the case with adsorption phenomena (*i. e.* the property which a soil may possess of removing a dissolved substance, such as a salt, permanently from solution), and more especially with selective adsorption (*i. e.* the property of removing a constituent of a dissolved substance, such as the base or cation of a salt, from solution).

As the result of fi e series of experiments carried out with various soils, the writer reached the following conclusions:

Soils not only have the power of adsorbing dissolved salts from solutions, but also of adsorbing one ion at a greater rate than the other, or of adsoibing selectively, to a marked extent.

The presence of bases of the soil (Ca, Mg, etc) in solution after shaking or lixiviating a soil with certain salt solutions is probably not due to a direct chemical reaction of the salt in solution with the silicates of the soil, but to a reaction of free acid, resulting from a selective adsorption of the cation, with the mineral components of the soil.

The rate of adsorption of chlorine ions from solution by soils is much slower than that of potassium ions. This selective adsorption of potassium by a soil from a potassium chloride solution increases with the concentration up to a certain point and then remains practically constant. On the other hand the percentage of potassium adsorbed from a potassium chloride solution increases as the concentration of the solution decreases, and at very low concentrations is practically complete. In general, too, the amount of potassium adsorbed from a solution of potassium chloride increases as the size of the soil particles decreases. In solutions of potassium chloride up to a strength of 37.5 gms. per litre, the presence of sodium nitrate decreases the adsorption of potassium; above this concentration it increases adsorption; but the presence of monocalcium phosphate has no appreciable effects on the adsorption.

Finally if a mineral fertilizer be applied to a soil and exposed to the rain and thus dissolved and carried through the soil in solution, these substances will be adsorbed either as a whole or selectively from the solution by the vast surface of the soil particles and will be held there by physical force until the plant removes them. The presence of other mineral substances added to the soil may or may not increase or decrease the rate at which this adsorptive phenomenon takes place.

205 - **Movement of Nitrates in the Soil.** — MALPEAUX, L. and LEFORT, G. (Ecole d'Agriculture du Pas-de-Calais) in *Annales de la Science Agronomique*, Year 30, No. 6, pp. 705-726. Paris, December 1913.

In a previous set of experiments (1), the writers showed that the movement of nitrates in the soil, caused by diffusion alone, was very slow, but that,

(1) See No. 109, *B*. Feb. 1913.

when caught by the evaporation current, nitrates may be brought up from deeper strata at a comparatively very rapid rate. Further, they showed that it was improbable that nitrate applied and ploughed in as an early spring dressing should be washed out of the soil even should the season prove a wet one.

During 1912 the experiments were continued. A piece of land was bastard trenched two spits deep, and divided into six plots which received the following treatment:

I.	Control, received no nitrate.					
II.	Received 4 cwt. of sodium nitrate p. acre as a surface dressing.					
III.	»	»	»	»	buried	5 cm. deep.
IV.	»	»	»	»	»	10 » »
V.	»	»	»	»	»	1 spit (17 cm.) »
VI.	»	»	»	»	»	2 spits (30 cm.) »

The nitrate was applied on April 12th, at which time the soil was in a good, workable condition, containing 14 per cent. of moisture. The plots were further divided right across the series, half of each being left uncropped while on the other half sugar beets were sown on April 18th. Throughout the season, at monthly intervals, the plots were sampled every 10 cm. to a depth of 40 cm., and analysed for nitrates by the Grandval-Lajoux method. A careful record was also kept of the rainfall.

I. *The Uncropped Soil* (Table I). The first sampling, which took place on April 5th showed that the soil in its natural condition contained about 1 mgm. of nitrogen as nitrate per 100 dry soil throughout the experimental zone and that the total nitrate content of the dressed plots was greater than that of the control plot by 6.5 to 7 mgm, of nitrogen per 100 dry soil, a figure which represents fairly accurately the calculated value of a dressing of 4 cwt. of sodium nitrate per acre. Between the first and second samplings only 1.1 in. of rain fell, and by May 16 there had occurred a rise of nitrate, chiefly noticeable in plots V and VI. The first half of June was very wet, and at the time of the third sampling (June 16th) the zone of maximum nitrate content had been washed from the top 10 cm. to the second 10 cm.; the third 10 cm. was also somewhat richer, but the rain had not washed the nitrates lower than this zone as the nitrate content of the fourth 10 cm. had remained practically stationary. A relatively dry period followed, and by July 16th the nitrates had clearly returned to the surface. Th.s again was followed by a month of almost continuous rain during which 4.2 in. fell; yet, in spite of this abnormally wet period, the nitrates on August 16th were chiefly gathered in the second and third 10cm. layers; the fourth layer too was somewhat richer than before, but it would appear that no nitrates had been washed below this zone, as the totals remained practically the same as at the previous sampling.

The mean distribution of nitrates for the season (*i. e.* the mean of all the samplings at each depth and on each plot) shows considerable variation on the different plots. While in I it was almost constant throughout the 40 cm.; in II, III and IV the surface layer was considerably the richest;

Nitrate as mgm. of nitrogen

Date of sampling	Rainfall in inches		Plot I Control, no nitrate — Depth of sample in cm. 0-10	10-20	20-30	30-40	Total	Plot II Nitrate spread on the surface — Depth of sample in cm. 0-10	10-20	20-30	30-40	Total
TABLE I. — *Uncropped soil.*												
April 15	April 15-30 = 0.2 May 1-15 = 0.9	1.1	1.2	1.0	0.9	0.9	4.0	7.8	1.4	0.9	0.9	11.0
May 16.	May 15-31 = 0.3 June 1-15 = 2.5	2.8	1.6	1.2	1.1	1.1	5.0	7.3	1.5	1.3	1.0	11.1
June 16	June 15-30 = 1.0 July 1-15 = 0.6	1.6	0.9	1.9	1.4	1.1	5.3	2.9	4.0	2.3	1.6	10.8
July 16.	July 15-31 = 2.5 Aug. 1-15 = 1.7	4.2	2.2	0.9	1.2	1.3	5.6	4.0	3.6	2.0	1.5	11.1
August 16			1.2	1.3	2.3	1.5	6.3	2.0	3.8	3.6	1.8	11.2
Totals . . .			7.1	6.3	6.9	5.9	—	24.0	14.3	10.1	6.8	—
Mean distribution. . . .			1.4	1.3	1.4	1.2	—	4.8	2.9	2.0	1.4	—
TABLE II. — *Soil under sugar-beets.*												
April 15	April 15-30 = 0.2 May 1-31 = 1.2	1.4	1.2	1.0	0.9	0.9	4.0	7.8	1 4	0.9	0.9	11.0
June 1	June 1-15 = 2.5 June 15-30 = 1.0	3.5	2.0	1.5	trace	1.0	4.5	6.8	1.7	1.1	1.0	10.6
July 1	July 1-15 = 0.6 July 15-31 = 2.5	3.1	1.0	1.0	1.4	1.2	4.6	2.4	3.2	2.0	1.6	9.2
August 1	Aug. 1-15 = 1.7 Aug. 15-30 = 2.1	3.8	1.0	0.8	0.7	1.3	3.8	1.6	1.8	2.6	1.6	7.6
August 30.			0.9	0.7	0.7	0.9	3.2	1.5	2.5	1.7	1.2	6.9

in V the second layer (10-20 cm.), where the nitrate had originally been buried, was richest, and the zone of distribution tended to increase; and in VI the most uniform distribution of all the dressed plots was obtained, without, however, any indication of loss of nitrate by washing down below the experimental zone.

II. *Soil under Sugar Beets* (Table II), The first sampling was the same as on the uncropped soil. The second sampling, on June 1st, after a fairly dry month, showed an accumulation of nitrate at the surface except in the case of plot VI, where the upward movement was nevertheless quite evident. At the third sampling the rains had washed the nitrates down to the second layer of 10 cm., and by August 1st the zone of maximum nitrate content was still deeper; but in this latter case the results were not so much due to

per 100 *dry soil.*

Plot III Nitrate buried 5 cm. deep.					Plot IV Nitrate buried 10 cm. deep.					Plot V Nitrate buried 17 cm. deep.					Plot VI Nitrate buried 30 cm. deep.				
Depth of sample in cm.					Depth of sample in cm.					Depth of sample in cm.					Depth of sample in cm.				
0–10	10–20	20–30	30–40	Total	0–10	10–20	20–30	30–40	Total	0–10	10–20	20–30	30–40	Total	0–10	10–20	20–30	30–40	Total
7.0	1.9	1.1	0.6	10.6	**6.8**	2.5	1.0	0.9	11.2	1.6	**5.8**	2.8	0.7	10.9	1.2	1.8	**4.9**	2.6	10.5
8.2	1.8	1.1	1.0	12.1	**7.0**	2.0	1.5	0.9	11.4	**4.0**	**4.0**	2.0	1.3	11.3	**3.0**	2.1	3.2	2.8	11.1
2.8	**4.5**	2.7	1.0	11.0	2.2	**5.0**	2.1	1.1	10.4	2.0	**4.9**	3.6	1.4	11.9	2.1	**3.5**	**3.5**	2.6	11.7
5.3	2.6	2.5	2.4	12.8	**5.0**	2.7	2.1	1.9	11.7	**4.8**	3.4	2.0	1.6	11.8	**4.2**	2.9	2.9	2.0	12.0
2.7	**3.6**	**3.6**	2.6	12.5	2.1	3.4	3.8	2.6	11.9	2.8	**3.7**	**3.6**	2.6	12.7	2.0	**3.4**	**4.6**	2.8	12.8
26.0	14.4	11.0	7.6	—	23.1	15.6	10.5	7.4	—	15.2	21.8	14.0	7.6	—	12.5	13.7	19.1	12.8	—
5.2	2.9	2.2	1.5	—	4.6	3.1	2.1	1.5	—	3.0	4.4	2.8	1.5	—	2.5	2.7	3.8	2.5	—
7.0	1.9	1.1	0.6	10.6	**6.8**	2.5	1.0	0.9	11.2	1.6	**5.8**	2.8	0.7	10.9	1.2	1.8	**4.9**	2.6	10.5
7.6	2.4	1.2	1.1	12.3	**5.5**	2.8	1.4	1.4	11.1	**4.6**	3.6	1.7	1.0	10.9	2.8	2.6	**3.3**	2.6	11.2
2.1	**3.7**	2.4	1.4	9.6	2.4	**3.4**	2.3	1.7	9.8	2.0	**3.0**	2.4	1.6	9.0	2.4	2.8	**3.1**	1.2	9.5
1.7	1.8	**2.2**	1.7	7.4	1.4	1.7	**2.6**	1.6	7.3	1.5	1.8	**3.4**	1.2	7.9	1.4	**2.1**	**2.1**	2.0	7.6
1.4	**2.5**	1.8	1.5	7.2	1.1	**2.0**	**2.0**	1.4	6.5	1.0	1.8	**2.4**	1.2	6.4	1.0	**1.8**	**1.8**	1.2	5.8

the washing by rain as to the depletion of the upper layers by the growing roots, the part played by the plant being indicated by the decreasing totals. The last sampling, on August 30th, showed a far more equal distribution of nitrates throughout the experimental zone than was obtained on the uncropped soil, owing to the fact that the influence of the rain is masked by the drying effect of the roots, which are at the same time reducing the nitrate content by absorption just where it would tend to accumulate.

The crop from the time of singling (end of June) onwards reflected distinctly the advantages of burying the nitrate; the differences became somewhat less marked towards the latter end of the season, yet the final weights when the roots were lifted at the end of October showed considerable differences in favour of the deeply sown nitrate.

Plot	Yield of sugar-beets p. acre. tons	cwt.
I Control	14	4
II. (surface dressing)	15	7
III. (5 cm. deep.)	16	8
IV. (10 » »)	17	0
V. (17 » »)	17	18
VI. (30 » »)	22	5

The whole investigation entirely confirms the conclusions previously drawn by the writer as to the necessity of applying nitrate for the beet crop early in the season, and of ploughing it in.

206 - **The Aluminium Reduction Method as Applied to the Determination of Nitrates in "Alkali" Soils.** — BURGESS, P. S. — *University of California Publications in Agricultural Sciences*, Vol. I, No. 4, pp. 51-62. Berkeley, California, May 1913.

The phenoldisolphonic method of determining nitrates in soil does not give satisfactory results where soluble salts are present, as in the case of "alkali" soils, and the following reduction method was tried as a substitute: 100 gms. of soil are mixed with 2 gms. of powdered quicklime and extracted with 200 cc. of distilled water. To 100 cc. of the extract 2 cc. of 50 per cent. caustic soda solution is added, and the liquid is reduced to half its bulk by boiling, in order to drive off ammonia. It is then washed into a large test tube fitted with a cork through which passes a bent glass tube drawn out into a point, a strip of aluminium foil is added, and the liquid is maintained at 20-22° C for 11 to 15 hours, after which the ammonia is distilled into $\frac{N}{10}$ acid. The method gave equally satisfactory results whether the soil contained large or small amounts of nitrates, or in the presence of "alkali" salts, neither was it less reliable when soluble organic materials such as soluble humus and dextrose were added to the soil.

207 - **Study of Hungarian Soils by Means of their Water Solutions.** - BALLENEGGER in *Földtam Köslöny*, Vol. XLIII, pp. 317-324. Budapest, 1913.

In the course of the autumn of 1912 the agricultural geologists of the Royal Hungarian Geological Institute of Budapest made a collection of the typical soils of Hungary, and the writer analysed the water solutions of 75 samples and determined electrical conductivity, at 18° C., alkalinity, dry residue before and after ignition, loss on ignition, mineral content, and especially the amounts of chlorine, lime and carbon dioxide. Besides, he determined the moisture of each sample.

The results of these analyses have shown that the water solutions may be used to characterise the various types of soils. Thus the grey forest soils contain the least amounts of soluble matter, their alkalinity and lime content are very low, while they are completely lacking in chlorine and carbon dioxide. On the other hand the brown forest soils give in general more concentrated water solutions.

In Hungary the most remarkable steppe soils are the chestnut-coloured and the dark brown ones. These are the most fertile of the Alföld, where they cover vast areas, especially in the angle formed by the rivers Tisza and Maros and in the southern part called Báeska. A characteristic feature of these soils is that the soluble substances and the alkalinity generally increase in the upper layers, then diminish to a minimum in the next layer, and increase again towards the subsoil.

In the Alföld there are vast areas of a black clay soil rich in humus, which was formerly the bottom of swamps and which drainage has now rendered cultivable. The distribution of soluble matter in these soils is the inverse of that of the chestnut and dark brown soils, but their content is much greater than that of the corresponding levels of the forest soils. Among these soils, the beginning of that accumulation of salts, which constitutes saline soils, is observed.

208 - **Quantitative Mineralogical Analysis of Sandy Soil.** — VENDL in *Földtani Közlöny*, Vol. XLIII, pp. 331-343. Budapest, 1913.

In order to determine the composition of a sand or of the sandy constituent of a soil, the methods hitherto employed were either complete chemical analysis or qualitative mineralogical analysis. The writer has succeeded in combining W. RETGER's method with microscopical and chemical analysis in such a way that he has been able to make a complete mineralogical analysis of the sand of the island of Csepel.

The process begins by separating the various minerals in very heavy solutions and fusions. According to their specific gravity, he separated the following groups of minerals

				Per cent
1)	2.5 to 2.6	Silica, potash-felspar	. . . .	0.04
2)	2.6 » 2.7	Silica	. . . .	71.38
3)	2.7 » 3.0	Carbonates, silica, micas	. . . .	21,73
4)	3.0 » 3.3	Amphiboles	. . . .	1.39
5)	3.3 » 3.6	Pyroxenes	. . . .	0.45
6)	3.6 » 4.8	Garnets, rutile, zircon	. . . .	0.84
7)	upwards of 4.8	Magnetite	. . . .	0.14

With the aid of the microscope the various minerals of each group were determined, and by complete chemical analysis their quantity in each group. Thus the following quantities of the various minerals were found:

	Per cent
Silica	73.70
Potash-feldspar	2.40
Soda- »	3.28
Lime- »	1.85
Carbonates (total)	11.82
Micas	4.00
Apatite	0.04
Amphiboles	1.35
Pyroxenes	0.45
Rutile	0.01
Zircon	0.01
Magnetite	0.14
Garnet	0.70

209 - *Bacillus radicicola* and Preparations for Soil Inoculation. - MAKRINOFF, I. in *Jurnal Opetnoi Agronomii*, Vol. XIV, No. 6, pp. 341-367. St. Petersburg, 1913.

The writer has subjected to bacteriological analysis the preparations for soil inoculation most widely distributed in Russia. At the same time he tested their effect on plant growth by means of pot cultures.

The bacteriological analyses showed that Kühn's liquid nitragin and Bottomley's nitrobacterine did not contain the specific organism, *Bacillus radicicola*, while Simon's "azotogen" and Kühn's "solid" nitragin contained about 50 per cent. of the bacillus amongst a mixed population of micro-organisms.

In the sand cultures the above preparations were compared with pure cultures of *Bacillus radicicola* and with fresh nodules. The best results were obtained with the pure cultures, while the "azotogen" and the nitragin, though less effective, gave satisfactory results. The nodules were least effective of all, but even in this case the plants attained a normal development.

210 - The Toxicity of Soil to Cabbage after a Crop of Sesame. — SKINNER J. J. in *The Plant World*, Vol. XVI, No. 12, pp. 342-346 + 1 fig. Baltimore, December 1913.

A sample of peat soil from Middle River, California, which had failed to grow cabbages after a crop of sesame, has been investigated by the writer. He found that a clear filtered aqueous extract of the soil had a distinctly injurious effect on water cultures of cabbage plants and to a much less extent on wheat. Treatment of the solution with finely divided carbon black appeared to remove the toxic effects (1).

A heavy oily body, semi-solid when cooled, was separated from the soil by extraction with hot alcohol. This oil is partly soluble in water, forming a solution which is very toxic to the growth of cabbage plants. The results of experiments with this substance are given in the following table :

	Cabbage		Wheat	
	green weight	relative	green weight	relative
Nutrient solution	3.36	100	4.50	100
» » + oily substance	2.80	83	4.30	96
Distilled water	2.00	100	2.42	100
» » + oily substance	1.75	88	2.35	97

Plots of the same soil on which no sesame had been grown produced good crops of cabbages. From these results it appears that a crop of sesame secretes substances toxic to cabbages, but not seriously injurious to wheat.

(1) Cf. No. 14, *B*. Jan. 1914. (*Ed.*).

MANURES AND MANURING

211 - **Tobacco Stalks as a Fertilizer.** — HASKINS, H. D. in *Twenty-fifth Annual Report of the Massachusetts Agricultural Experiment Station*, Part II, pp. 80-84. Boston, 1913.

As the tobacco plant is a heavy feeder and is cut before the plant has a chance of developing its seed, it is obvious that a large quantity of fertilizing elements must remain in the stalks. Analysis of the latter yielded the following results:

Per cent of dry matter.

	Stalks from which the leaves were stripped:	
	I. after curing*	II. in a green condition**
Nitrogen	3.25	1.10
Potash	4.95	1.00
Phosphoric acid	0.78	0.26

* Havana Seed Leaf variety. — ** Another variety.

From statistics collected for Havanna Seed Leaf: 8666 plants are usually grown per acre, and the average weight of 10 stalks (stripped) is 6.58 lbs., that is 5 702 lbs. per acre. Assuming that the stalks contain 52.94 per cent. of water, the residue of dry matter produced would be 2684 lbs. per acre, containing the following amount of fertilizing material:

	lbs. per acre
Nitrogen	87.23
Potash	132.85
Phosphoric acid	20.94

Applying the commercial values usually assigned to such material in cotton seed meal or other organic manures, tobacco stalks would be worth about $ 24 per acre, or about $ 8.40 per ton of partially dried stalks (*i. e.* containing 50 to 53 per cent. of water).

Usually tobacco stalks are thrown out on the land in autumn, left exposed to the rain and snow during the winter, then gathered into heaps and burnt in the spring, the ashes being scattered over the land. Analyses of unexposed and leached stalks showed that only a little over 50 per cent. of the nitrogen was washed out during the winter, probably consisting of nitrates and the more soluble amide compounds; therefore the spring burning dissipates about 40 lbs. of nitrogen per acre, valued at $ 7, besides destroying a considerable amount of valuable organic matter. It is recommended that the practice be discontinued, and that the stalks be chopped up and buried.

212 - **On the Composition of Giant Kelps.** - MERZ, A. R. (Bureau of Soils, U. S. Department of Agriculture) in *The Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 1, pp. 19-20. Easton, Pa., January 1914.

The data presented were obtained in the course of investigations directed by Dr. F. K. Cameron, of the Bureau of Soils, during the summer

of 1913, on the possibility of utilizing the beds of gant kelps on the Pacific coast as an economic source of potash salts (1).

The dry material was analysed according to the methods published by Turrentine (*Jour. of Ind. and Eng. Chem.*, IV, 431, 1912) and yielded the following results:

Seaweed	Total soluble salts	Potash	Ash	Iodine	Nitrogen
Alaria fistulosa . . .	15.16 to 32.30	2.27 to 13.07	4.41 to 15.08	—	2.05 to 15.08
Nereocystis sp. . . .	34.38 to 64.44	12.74 to 30.12	2.76 to 10.66	0 to 0.14	0.81 to 3.06
Macrocystis sp. . . .	19.46 to 45.76	6.92 to 22.48	4.07 to 6 92	0 to 0.30	1.08 to 2.69
Fucus sp.	17.24 ro 17.52	3.48 to 3.51	4.48 to 5.44	—	1.18 to 5.21
Porphyra sp.	23.54	7.33	4.22	—	5.21

The results indicate that the *Nereocystis* of Alaskan waters is as important as that of more southern seas so far as the potash content is concerned. *Macrocystis* contains a lower percentage of potash than *Nereocistys* and *Alaria* is lower still, while *Fucus* and *Porphyra* are valueless for potash extraction on a commercial scale.

Another series of analyses carried out on *Macrocystis* sp. gathered at La Jolla, California, confirmed previous conclusions that freshly cut seaweed suffers no leaching effects from a short immersion in sea water.

As a certain amount of doubt exists as to the differences in composition between the laminae and stems of the seaweeds (2), the following analyses are of interest.

Seaweed	Part of plant	Parts per cent				Locality
		Potash	Total soluble salts	Ash	Nitrog.	
Nereocystis sp.	lam.	9.90	25.94	3.88	0.84	Alaska
	»	15.44	39.40	4.34	2.27	
	stem	28.26	52.88	3.60	1.06	
Postelsia palmaeformis . . .	stem	22.8	44.5	3.2	0.94	California
	lam.	9.7	29.7	4.3	1.40	
Macrocystis pyrifera. . . .	stem	18.7	40.3	5.3	1.24	California
	stem and lam.	12.4	28.3	6.9	1.04	

(1) See No. 1147, *B.* Aug. 1912. (*Ed.*)

(2) See CAMERON F. K. Kelp and other sources of Potash. — *Journal of the Franklin Institute*, CLXXVI, 364, 1913.

From these results and those of eight other samples analysed at the same time, the writer concludes that the nitrogen and the ash content are almost invariably larger in the leaves than in the stem of the same plant, and that the total soluble salts and the potash are more abundant in the stems than in the leaves.

213 - **Investigations on the Availability of Phosphatic Manures.** — JORDAN, W. H. (Studies in Plant Nutrition: I.) *New York Agricultural Experiment Station, Bulletin* No. 358, pp. 30. Geneva, N. Y., February 1913.

Manurial experiments were carried out with (*a*) superphosphate, (*b*) ground Florida rock (floats), (*c*) basic slag, (*d*) dehydrated Redonda phosphate, (*e*) bone meal, (*f*) iron ore waste. The plants were grown in cans and boxes containing either a poor sandy soil or a pure quartz sand, or a quartz sand to which 3 per cent. of sphagnum moss had been added, and all received in addition to the phosphatic manures other mineral salts to make the manure complete. Cereals, root crops and leguminous fodder crops were used as test plants.

The results point, in the first place, to the general conclusion that the availability of the phosphate is quite as much a matter of the kind of crop as of the form of combination of the phosphoric acid. Cruciferous crops (cabbage and rape) made use of the phosphoric acid in ground rock phophate without difficulty, while to the cereals (barley, millet and oats) it was practically useless. On the whole superphosphate produced the greatest amount of plant growth, though basic slag was not far behind. Redonda phosphate, though classed below the two above fertilizers, gave better results than ground Florida rock.

The influence of fineness on the availability of phosphates was investigated by using ground rock phosphate and bone meal of various degrees of fineness, varying from a fine powder such as " floats " (which will go through a bolting cloth) to a texture obtained by passing the manure through a sieve with 60 meshes to the inch. Three successive crops of rape obtained in 1899-1909 exhibited no increase with the more finely divided fertilizers, but when the experiments were repeated in 1903-1904 on a more favourable soil produced by the addition of sphagnum moss to the quartz sand, peas, barley and rape all assimilated increased quantities of phosphoric acid as the fineness of the fertilizing material increased, the amount of phosphoric acid yielded by the ground rock "floats" being almost twice as great as that yielded by the coarse material. In the case of bone meal the degree of fineness had much less effect. The proportion of phosphoric acid in the dry matter of the crop increased with the fineness of division of the ground rock, *i. e.* was proportional to its availability.

Manurial tests carried out with an iron ore waste containing 15.45 per cent. of phosphoric acid showed that it was of little use to barley ; the following table shows clearly how little adapted cereals are to utilizing the phosphoric acid of mineral phosphates before the latter have been chemically treated.

Relative availability of phosphoric acid from different sources as measured by chemical methods or shown by plant production (monocalcium phosphate taken for comparison).

Method of determining availability	Available phosphoric acid in:									
	Mono-calcium phosphate		Iron ore waste		Basic slag		Ground Tennessee rock		Bone	
	gms	rel. wt.	gms	rel. wt.	gms	rel. wt.	gms	rel. wt.	gms	rel. wt.
1. Official U. S. A.	5.82	100	0.117	2.0	2.49	42.8	0.168	2.9	1.72	29.5
2. Wagner	5.82	100	0.195	3.3	5.13	88.1	1.25	21.5	5.07	87.1
	Dry matter produced by barley, less amount on checks									
Plant production	32.8	100	6.0	18.3	30.5	93.0	17.5	53.3	36.5	111.3

214 – **The Solubility of Mineral Phosphates in Citric Acid.** — ROBERTSON, G. S. in *Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 1, pp. 9-11. London, January 15, 1914.

Quite recently artificial manure manufacturers have placed on the market large quantities of mineral rock phosphates as a suitable phosphatic manure. These rock phosphates, in spite of the fact that they are very finely ground, are only slightly soluble in 2 per cent. citric acid. They were therefore assumed to be of little use as an available manure compared with basic slag and bone meal, in which 80 to 95 per cent. of the phosphates are soluble in 2 per cent. citric acid... However, in a series of field trials carried out at Cockle Park (Northumberland) they gave excellent results on grass land, as will be seen from the following summary of the yields obtained:

Field Experiments on Three Years' Ley.

Manure	Number of plots	Total number of years	Average yield of hay per acre.
			cwt.
Slag (200 lbs P_2O_5 p. acre)	5	13	40.3
Bone Meal » »	2	5	39.7
Min. Phosphates » »	5	12	41.0
No Manure	2	5	35.2

With the object of finding a satisfactory explanation of the successful results obtained with rock phosphate, calcined and uncalcined samples of the Belgian and Tunisian varieties were subjected to 5 consecutive extractions in 2 per cent. citric acid, which showed that the rock phosphates are completely soluble in citric acid if enough of it be used and enough time spent on the extraction. The first extraction contained more lime than any other and the second and third gave the bulk of the phosphates. As the process rendering the phosphates soluble in the soil is a continuous one, these so-called "citric-insoluble phosphates" give as good results as the high citric-soluble slags, the citric acid test, as commonly performed, having given a test for lime content rather than phosphate content.

The cost of a unit of phosphate in rock phosphates is only about 9*d*, whilst in basic slag it is about 1*s* 4*d*. It will therefore be readily understood that the use of rock phosphates might prove of considerable economic importance.

215 - **Influence of the State of Fineness of Superphosphate and of Basic Slag on their Efficiency.** — MIKULOWSKI POMORSKI, J. (Mitteilung der agricultur-chemischen Versuchsstation in Dublany) in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oestereich*, Vol. XVI, No. 11-12, pp. 1044-1055. Vienna, November-December 1913.

From the time of Liebig it has been commonly held that fineness of texture is an important factor in the efficiency of superphosphate. The experiments of P. Wagner proved how essential was fineness in the case of basic slag, but there is altogether little experimental evidence on the subject, especially with regard to superphosphate; in order to investigate the matter further, two series of culture trials were carried out with oats. The plants were grown in jars containing 13 lbs. of a loess soil, deficient in phosphoric acid. For the first year's trials, the superphosphate and basic slag were mixed with 3 per cent. of gypsum used as a cement material, then pounded up and graded by means of sieves into particles of different sizes (0.5 - 1 mm., 1 - 1.5 mm., 1.5 - 2 mm.), while another portion of the mixture was again reduced to a powder. The second season superphosphate alone was tested; it was cemented with agar and reduced to particles 0.5 cc. in size and to a fine powder. The manure was applied in the first series by mixing the dressing with the uppermost third of the soil in the jar, but in the second series the dressing was mixed with the entire contents of the jar. Further tests were carried out with the first series (consisting of 18 units of 3 jars each) on the effect of adding sodium nitrate and potassic salts; while in the second series (consisting of 8 units) all jars received the additional nitrate and potash.

The results show that superphosphate cemented by gypsum to particles 2mm. in size, or treated with agar, is no less effectual than when in the condition of a fine powder; in fact the samples treated with gypsum sometimes gave better results. The depth at which the manure was buried seemed of more importance than its degree of fineness. The phosphoric acid in basic slag, on the other hand, was less available when the manure had been treated with gypsum. From these results the following conclusions were drawn:

a) It is unnecessary to exact a great degree of fineness in superphosphate, as up to a certain point a rather coarse texture may be an advantage, amongst other reasons because it prevents pasting in the bags.

b) Superphosphate is far better adapted than basic slag for applying in the furrows together with the seeds at drilling time, as the pasting of the latter is likely to decrease its efficiency.

216 – **A New Fertilizer: Molassed Superphosphate (Superphosphat schlempe).** — STOLTZENBERG, H. in *Chemiker-Zeitung*, Year XXXVIII, No. 8, pp. 81-82. Cöthen, January 17, 1914.

The residues from the distillation of molasses were at one time thrown away, but they were soon recognised to be of manurial value as they contain nitrogen and potash, and were sold to farmers who applied them to such crops as mangolds, potatoes, tobacco and hops, though their sowewhat rapid decomposition and great bulk prevent their being used very extensively. Most of the sugar factories, however, concentrate and ignite their residues to recover the potash, or sell them in a concentrated condition to cyanamide works, which recover not only the potash but also 60 to 70 per cent. of the nitrogen as potassium cyanide and ammonium chloride. Even in these cases, 30 to 40 per cent. of the nitrogen and all the organic matter are lost, and for this reason efforts have repeatedly been made to transform these residues into a solid easily handled manure, either by drying the material or by mixing it with other substances. So far these efforts have proved unsuccessful, as the product has always been hygroscopic.

The reason for this is the presence in the residues of hygroscopic organic bases, more especially of betaine. Now Andrlik has shown that the acid phosphate of betaine is not hygroscopic, and the writer obtained a friable, non-hygroscopic product when he treated the concentrated residues from the molasses with a calculated amount of phosphoric acid and then dried the mixture. Better results still were obtained when the residues were mixed with superphosphate and the mixture heated for a short time at 108° C (226° F). The material thus prepared is friable, keeps well and is easy to apply. Molassed superphosphate obtained by mixing 3 parts of superphosphate with 2 ½ parts of concentrated residues contains 2.25 per cent. of nitrogen, 6.33 per cent. of potash and 11.53 per cent. of citrate-soluble phosphoric acid (8.48 per cent. water-soluble), and yields 57.32 per cent of residues on ignition consisting of soluble calcio-potassic phosphate, potassium and sodium sulphate and chloride, gypsum and non-decomposed phosphate from the superphosphate. The manure is made up of 50 per cent. of soluble substances and of 30 per cent. of undecomposed organic substance. If required, nitrate of soda, sulphate of ammonia or potash salts may be added in order to increase the nitrogen or potash content. The product does not damage sacks and has the avantage over other fertilizers of providing humus material as a basis for bacterial development in the soil.

Attempts to obtain analogous compounds, such as molassed slag or molassed cyanamide, with a preliminary treatment of the residues to render them non -hygroscopic, have not so far yielded practical results.

217 – **Secondary Constituents of Basic Slag.** — DEMOLON, A. and BROUET, G. (Station agronomique de l'Aisne) in *Journal d'Agriculture Pratique*, Vol. 138, No. 1, pp. 22-23. Paris, January 1, 1914.

A characteristic feature of present day investigations in soil fertility is the proposed use of fertilizing elements other than nitrogen, phosphorus and potassium, such as, for instance, manganese, boron, zinc, lithium, magnesium, fluorine, sulphur. The majority of agriculturists, however, have not yet been convinced of the utility of these elements in ordinary practice.

Basic slag contains not only phosphoric acid but also oxides of manganese and of magnesia, derived respectively from the ferromanganese introduced into the converters and from the linings of the converters themselves (see Table).

Analyses of Basic Slag carried out at the Experimental Station (Aisne).

Samples	Total Phosphoric acid	Manganese			Total Lime	Magnesia
		Total	sol. in 2 % citric acid	sol. in 3 % acetic acid		
1	17.40	5.54	1.84	1.47	—	—
2	18.87	4.72	1.84	1.21	43.00	16.41
3	15.23	4.72	2.27	1.11	—	—
4	18.20	4.55	1.61	0.94	—	—
5	17.65	5.34	3.59	1.27	45.19	3.24
6	17.80	5.16	2.77	1.30	—	—
7	17.78	4.72	1.98	1.16	44.80	10.14
8	18.60	5.20	1.50	1.06	—	4.50
9	18.16	4.07	1.64	1.08	—	13.86
10	18.80	4.21	2.67	1.47	—	—
11	15.35	3.93	2.77	1.44	—	—
Mixture of 10 other different samples . .	—	4.10	3.59	2.68	48.02	10.05

The above analyses show that the manganese content of basic slag is fairly constant and in the neighbourhood of 4 to 5 per cent., while its solubility in citric acid indicates that it is present in a condition available to plants. An application of 6 parts of slag would be equivalent to 2 parts of manganised lime, so that if manganese plays a useful role in plant nutrition it cannot be lacking where slag is employed as a manure. The magnesia content of slag is more variable, averaging about 10 per cent.; the lime-magnesia ratio, however, usually remains within the optimum limits laid down by plant physiologists. An application of 5 parts of slag would be equivalent to 1 part of lime-magnesia manure such as is now on the market.

	Series of plots I	Series of plots II	Average	Surplus over control plot
	lbs.	lbs.	lbs.	lbs
Without manure, control	3 445	3 411	3 428	—
Broadcasted manure	6 740	6 678	6 709	3 281
Drilled manure	9 375	9 362	9 368	5 940

The Hatvan estate having found that drilling manure is more advantageous than broadcasting it, has definitely adopted the former method for all the crops.

219 - **Manurial Experiments in Palestine.** — *Les Mercuriales Agricoles*, Vol. III. No. 94, pp. 36-39. Antwerp, January 16, 1914.

The following data are taken from the report of Dr. Keller, director of the agricultural school at Wilhelma (near Jaffa), on manurial experiments carried out in 1912-13. They show what an important part fertilizers will be called upon to play in the production of agricultural crops in that country.

Up to the present, fertilizers have only been used by the German colonists, and by native cultivators immediately surrounding the German colonies. Manurial trials have now yielded sufficient data for practical conclusions to be drawn ; it is quite evident that only fertilizers increase the returns, as dung, which in Palestine consists of refuse from ruined villages, does not give the same good results. With suitable dressings of fertilizers, yields amounting to 25 bushels of wheat or barley per acre were obtained, and though these will certainly be further increased eventually, they already represent a distinct advance on the yields of native cultivators, who generally harvest no more than twice the amount of grain originally sown as seed. With the increased fertility of the soil its feeding capacity has also increased and whereas previously 11 acres were considered necessary per head of cattle, now less than 5 acres are deemed sufficient, and sales of dairy produce rose from £1680 in 1910 to £3360 in 1912.

With regard to the manures used, sulphate of ammonia has been almost exclusively employed as a source of nitrogen, because the importation of nitrate of soda was prohibited up to 1910, but the price of the former has now risen to such a height that it will be replaced more profitably by nitrate. Phosphoric acid in the form of superphosphate, and 40 per cent. potash salts are the other most suitable manures. For cereals the following dressing is recommended :

4 to 5 cwt. superphosphate per acre
2 to 4 » potash salts per acre
1 » nitrate of soda (as a top dressing)

This would cost 37*s*. to 39*s*. per acre.

Manurial trials with sesame and maize have only given negative results so far, possibly because the manures were applied too late in the season when there was not sufficient moisture in the soil to dissolve them properly.

The following results were obtained in 1912-1913 on a heavy clay soil which has been in cultivation 8 years and which had received a dressing of dung in 1906.

Crop yields per acre.

Crop	No manure		1½ cwt. nitrate per acre		1½ cwt. nitrate 6 cwt. superphosphate per acre		1½ cwt. nitrate 6 cwt. superphosphate 3 cwt. potash salts per acre	
	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Oats and vetches . .	1	17	3	3	3	19	4	9
Beans		10	—			14		15
Mangolds	11	5	18	0	23	0	26	11
Cabbage	4	8	—		16	8	—	
Beet root	1	0	—		—		10	16

220 - **The Minimum of Plant Food required for Maximum Production.** — JORDAN, W. H. Studies in Plant Nutrition: II. — *New York Agricultura Experiment Station, Bulletin* No. 360, pp. 53-77 + 8 figs. Geneva, N. Y., February 1913.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

These experiments were devised with a view to ascertaining the essential minimum amount of available phosphoric acid and potash required to produce maximum growth. The crops used included barley, peas, tomatoes, tobacco, buckwheat, rape and turnips.

Two sets of cultures contained all the required elements except phosphoric acid and potash respectively, one of these elements being added in progressive quantities to the several cultures of each set. The conditions of temperature and moisture were under control and were as far as possible regulated so as to fully satisfy the requirements of the plants throughout the experiments. The results obtained show considerable uniformity amongst the different crops.

No fixed relation exists between the production of dry matter and the amounts of phosphorus and potash utilised. Up to a somewhat indefinite point the production of plant substance increased in most cases with increase in the supply of the variable constituent, but beyond that point increase in the consumption of both phosphorus and potassium compounds only resulted in an increase in the proportion of phosphorus and potassium in the plant tissues and not to a corresponding increase of plant growth.

The results also confirm the conclusion that the chemical analysis of a given crop is no certain criterion of the manurial requirements of that particular crop.

221 - **The Use of Radium as a Means of Forcing Plants.** — MOLISCH, H. in *Die Naturwissenschaft*, Year II, Part 5, pp. 104-106 + 3 plates. Berlin, January 1913.

The writer has, for more than two winters, investigated the effect upon resting portions of plants of solid radium emanations. The budding of branches of lilac (*Syringa vulgaris*), for instance, was accelerated by the effect of radium, provided they were exposed to its influence at the right season (end of November and in December), and not for too long or too short a time, one or two days being sufficient. Unless these conditions are observed, the preparations had either no effect or a harmful one upon the buds.

The experiments with emanations, which produce a more equal effect upon the buds than can be obtained by the use of solid preparations, were attended with very good results. The longer the emanations lasted (20, 48, 72 hours) the greater was their effect.

Not all plants, however, can be forced by radium. The experiment has at present no practical value, since the same effect can be produced by the use of simpler and less costly means.

222 - **Phosphoric Substances in Meadow Hay.** — DUSERRE, M. C. (CHAVAN, P. and TSCHUMY, L.) in *Archives des Sciences Physiques et Naturelles*, Year CXVIII, Vol. XXXVI, No. 12, pp. 578-581. Geneva, December 15, 1913.

Phosphorus compounds being of great importance in animal economy, the writers investigated the compounds of that nature contained in meadow hay. They distinguished three groups of compounds:

1) *Phosphatides*, consisting chiefly of lecithins and extracted by boiling alcohol.

2) *Phosphates*, soluble in dilute acids, together with *phytin* which decomposes into phosphoric acid and inosite.

3) *Nucleo-proteids* or proteins, insoluble in the above reagents.

Various samples of hay from different meadows were examined and their phosphorus content was distributed as follows:

	I	II			III
		1910	1911	1912	
	per cent	per cent.	per cent.	per cent.	per cent.
Phosphorus in the form of:					
Lecithins	4.0	4.0	7.8	6.8	6.3
Phosphates and phytins	54.3	55.8	62.1	61.1	54.3
Nucleo-proteids	41.7	40.2	30.1	32.1	38.4

These results show that more than half the phosphorus in hay is present in the form of phosphates and phytins, and that 30 to 40 per cent. is in the form of nucleo-proteids, while the amount in the form of lecithins is less than 10 per cent.

The application of phosphatic manures to meadows increases the phosphorus content of the hay, more especially that part present in the form of phosphates and phytin, as shown in the following tables.

	I			II		
	Yield of hay per acre	Phosphorus		Yield of hay per acre	Phosphorus	
		per cent. in hay	lbs. per acre		per cent. in hay	lbs. per acre
	cwt.			cwt.		
Unmanured	19.9	0.108	2.41	11.9	0.157	2.09
Superphosphate	20.3	0.191	4.73	24.3	0.235	6.40
Potassic super	29.4	0.199	6.55	31.9	0.233	7.96

Assuming that lecithins and nucleo-proteids have a mean phosphorus content of 4 per cent. and 5 per cent. respectively, and that all the phosphorus extracted by dilute acids be in the form of phytin, the production per acre of the various groups of phosphorus compounds was:

	II			III		
	Lecithin	Phytin	Nucleo-proteids	Lecithin	Phytin	Nucleo-proteids
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Unmanured	4.10	5.64	15.79	3.52	4.39	16.02
Superphosphate	6.11	13.38	20.02	9.32	15.21	41.16
Potassic super	8.47	18.38	28.44	17.62	17.33	54.73

The application of phosphatic manures to meadow land, supplemented when required by potassic and nitrogenous fertilizers, therefore increases considerably the amount of phosphatic compounds produced on a given area, the forage being not only more abundant but also richer, and permitting more intensive feeding of the grass land.

223 – **Characters of the Grain in Varieties of Hungarian Pedigree Wheat and their Hereditary Transmission.** — OBERMAYER, ERNÖ in *Köztelek*, Year 23, No. 93, pp. 3133-3134. Budapest, November 29, 1913. PLANT BREEDING.

The writer gives an illustrated description of the grains of the pure types obtained by pedigree selection of the Diószag and Somogy Hungarian beardless wheats, and demonstrates that the various forms selected from the same variety differ not only in their development and in the morphological peculiarities of the plants, but also in the character of their grain. In order to determine these differences, the writer discusses the visible variations of form of the seeds (long, short, etc.): he shows that though the size (weight) and colour of the grain are subject to some change according

to the seasons, these characters, and still more the form of the grain, show uniformity in all the descendants of each of the pedigree types and are transmitted pure. The hereditary transmission of the characters of seeds was determined according to the examination of the crops harvested in 1910, 1911 and 1912.

224 – **Increase of the Productivity of Hungarian Wheat by Means of Selection.** — GRABNER, EMILE in *Köztelek*, Year 23, No. 99, pp. 3331-3333. Budapest, December 24, 1913.

The productivity of Hungarian wheat not being susceptible of increase by the development of its tillering, on account of the consequent late ripening, the writer recommends the selection of ears bearing three or four grains per spikelet, instead of the two usual in Hungarian wheats. Among the pure types obtained by the selection of Hungarian wheat (effected at the Hungarian Station for Plant Selection), and the characters of which differ essentially, there are several which answer to the above requirements. Notwithstanding the climatic conditions during flowering time, frequently injurious to pollination, the spikelets of these selected types are distinguished by a large number of grains: three and four, rarely five, in which case they are very small.

225 – **A Many-eared Variety of Maize obtained by Selection in Hungary.** — GRABNER, EMILE in *Gazdasági Lapok*, No. 51, p. 850. Budapest, 1913.

In 1911 the seeds of 25 ears of Pignoletto maize taken from plants bearing four ears, selected in 1910, were sown in the experiment fields of the Royal Hungarian Institute for Plant Selection at Magyaróvár. The numbers of stalks obtained in 1912 are shown in Table I.

The parent ears classed in the first and second groups are the descendants of two of the ears of a stalk bearing four ears selected in 1910, whilst the third group comprises the descendants of the two other ears of the same stalk.

In 1913 the seeds from the stalks with 7 and 12 ears mentioned in table I were sown; whilst in the plants of the 1912 harvest the majority of ears did not grow directly on the main stalk but on the longer side shoots, in the 1913 crops as well as in the parent plant of the first selection (1910) the stalks bore the ears directly on the main shoot.

The hereditary transmission of the number of ears on the 1913 crops is shown in Table II.

TABLE I.

Number of ears on the stalk	No. of parent ear: 1st group I	II	III	IV	V	VI	VII	VIII	IX	2nd group I	II	III	IV	V	VI	VII	3rd group I	II	III	IV	V	VI	VII	VIII	IX
1	8	4	11	11	11	12	18	13	12	13	21	20	12	8	20	14	7	20	20	11	17	10	18	1	14
2	39	34	27	29	20	31	29	31	31	30	24	25	18	28	26	26	34	25	24	23	21	34	23	41	20
3	3	10	4	9	10	10	7	9	11	10	9	4	14	9	4	4	7	5	7	10	9	8	5	8	11
4	—	2	2	3	5	1	2	3	5	3	3	—	6	1	3	1	4	2	3	4	2	3	2	5	8
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—

NB. The Arabic figures in the various columns represent the number of stalks obtained.

TABLE II

Number of ears on the stalk	Parent plant with 7 ears						with 12 ears			
	I	II	III	IV	V	VI	I	II	III	IV
1	8	6	20	9	4	5	13	21	14	19
2	10	24	34	33	11	15	14	7	9	6
3	14	13	14	9	9	1	4	2	—	2
4	7	10	4	4	—	—	—	1	—	—
5	1	2	2	1	—	—	—	—	—	—
6	5	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—
	1	—	1	—	—	—	—	—	—	—

The yield of stalks obtained from the ears no I. of the parent stalk with 7 years shows the excess of stalks bearing more numerous ears over those bearing one or two ears.

Average yield of whole ears.

	grams
Stalk with 1 ear	81.3
» » 2 »	128.4
» » 3 »	182.5
» » 4 »	220.8
» » 5 »	253.6
» » 6 »	247.8
» » 8 »	189.7

The much lower yield of the stalk bearing 8 ears is due to the fact that 4 of the ears remained sterile.

226 - **Plant Breeding and Selection in New Zealand.** — GREEN, A. W. in *New Zealand Department of Agriculture, Journal of Agriculture,* Vol. VII, No. 5, pp. 482-487. Wellington, November 1913.

Selection experiments are in progress with all the more important farm crops, fruits and vegetables. The main object at present is the isolation of disease-resistant forms. Up to the present time, success has been achieved in the production of a new rust-resistant variety of oats (known as Ruakura Rust-resistant) from a single head selected in 1908. Over 100 acres are now under this crop at Ruakura alone, and some 220 farmers have received free samples.

CEREAL AND PULSE CROPS.

227 - Cultivation Experiments with Loose-Eared Varieties of Winter Wheat.— MUNDT, L. in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 248. Berlin, 1913.

In this publication, the writer gives a summary and account of the results of the experiments carried out with loose-eared varieties of winter wheat by the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft) in the years 1908-1910. The experiments extended throughout Germany, which is divided into 12 cultural districts. In 1908, 25 reports were sent in; the number of experimenters rose in 1909 to 37, and in 1910 to 43.

These experiments are of the greatest importance to the experimenter, since thereby he ascertains, in the simplest and surest manner, the varieties which are most suitable to his farm. They are also of great general importance, for they are carried out in the most different districts of Germany and under the most various conditions of soil, climate and cultivation, and are thus valuable as a means of ascertaining the characteristics of the different varieties.

The experiments described by the writer are partly principal experiments, and partly preliminary trials of new varieties. In the principal experiments the following wheats were grown for comparison: Orig. Rimpau's Hybrid, Orig. Criewener 104, and East Prussian Epp.

Considering only the thoroughly reliable experiments, the following average yields of grain (in lbs. per acre) were obtained:

	Rimpau's Hybrid	Criewener 104	E. Prussian Epp
1908	2936	2545	2523
1909	2246	2402	2181
1910	2086	2237	1976

It is thus seen that Rimpau gave the highest yield in 1908 and Criewener in the other two years. As regards straw yield and duration of growth there is little difference between the three varieties; the same may be said in respect to resistance to disease. As the winters during which the experiments were made happened to be very mild, little can be said as to the capacity of these wheats for withstanding cold; the most resistant was, on the average, the East Prussian Epp wheat. Criewener 104 takes the first place as regards resistance to lodging, the worst being East Prussian Epp. With respect to the flintiness of the grain, Rimpau's Hybrid was far superior to the two others; this, together with its higher gluten content, is the best evidence that it will produce the finest flour for bread making.

Preliminary experiments were carried out in these years with eight other varieties. A final decision as to their value cannot yet be made; for this, further and more extensive experiments are necessary.

228 - **Studies on the Stem-Anatomy of Wheat and its bearing on Classification.** — BLARINGHEM, L. and MIÈGE, E. in *Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 25, pp. 1457-1460. Paris, December 22, 1913.

The classification of the varieties of wheat belonging to the species *vulgare, compactum, dicoccum, turgidum*, etc., has not yet been satisfactorily achieved. In spite of numerous attempts at classification by various authorities, considerable doubt remains as to the actual value of the various subdivisions. With a view to throwing some light on these difficulties, the writer has made an anatomical study of the stems of numerous varieties of wheat.

He finds that:

1) The differentiation of the tissues increases in passing down the stem and is more pronounced in winter than in spring wheats. This differentiation consists in a thickening of the cell walls, an increase in the number and size of the vascular bundles, and a wider distribution of them, naturally associated with a thicker stem.

2) The anatomical structure of the stems of *T. spelta, T. durum* and *T. monococcum* is very uniform and distinct, especially with regard to the number, dimensions and distribution of the vascular bundles.

3) The stem structure of *T. vulgare, T. dicoccum* and *T. turgidum* is far from constant; various strains of them show affinity in this respect with the above-mentioned species.

4) Hybrids between *T. monococcum* and *T. durum* have the stem characters of *T. dicoccum*, and crosses of *vulgare* × *turgidum* resemble *spelta* and *durum* wheats.

Thus it would appear that such polymorphic species as *dicoccum, turgidum* and *vulgare* have originated as hybrids. These results also support Naudin's theory, according to which the stem structure of hybrid wheats would be a heterogeneous and unstable mosaic of characters occurring in a stable form and inherited without change in the forms *spelta, durum* and *monococcum*.

229 - **Observations on some Characters of Hard and Tender Barleys.** — VINE, H. C. A. in *The Journal of the Institute of Brewing*, Vol. XIX (Vol. X. N. S.), No. 6, pp. 413-452 + 3 plates. London, October 1913.

With a view to extending our knowledge of the factors causing "steeliness" or "hardness" in barley, the writer has made a detailed histological examination of numerous grains of hard and soft or mealy barley from different harvests and different countries. It has long been known that harvests unfavourable to the proper maturation of the grain give rise to a greater percentage of hard grains of inferior malting quality. This inferiority has been chiefly attributed to the condition of the gluten and the nitrogen content of the grain.

The writer's investigations show that among other factors the following are very important: 1) the condition of the cell walls of the endosperm, and 2) the size of the starch granules.

By means of suitable staining and microchemical tests he has shown:

1. That the cell walls of the endosperm consist of resistant laminae uni-

ted by more plastic layers, and that the disintegration of these laminae by the enzymes during the process of malting and brewing is more difficult and much less complete in hard than in tender ones.

2. That the proportion of small or rudimentary starch granules is much higher in hard than in tender barleys; these small granules, owing to the presence of an intact outer covering or cellulose envelope, are much more resistant to the action of enzymes, moisture and temperature than the mature granules of normal size.

Further investigations are being made concerning the percentage of phosphoric acid.

230 - **Eight Years' Cultivation Experiments with Beans.** — ZIFFER, A. *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 249. Berlin, 1913.

This paper is the first detailed report on the results of experiments in the cultivation of several varieties of horse beans conducted by the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft), in cooperation with other bodies, from 1905 to 1912. The experiments were carried out on a uniform plan and as they extended all over Germany and under the most varied soil, climatic and economic conditions, they are of the greatest importance for forming an opinion as to the merits of the different varieties. The writer discusses, in the introduction, the principles according to which the experiments were conducted; he further gives a sketch of the weather conditions during the years that the experiment lasted, and an exhaustive description of the different varieties tried.

The experiments were divided into preliminary and main experiments. In the years 1905 only the former were carried out and with the following varieties: Eckendorf, Small Thuringian, Halberstadt and Dutch Marsh beans. During these preliminary experiments the Small Thuringians were three times first as to yield and may be considered as the most productive; the second place was occupied by the Halberstadt beans and the third by the Eckendorf. The yields of the Dutch marsh beans varied very much and did not allow of any reliable conclusions being drawn.

On the basis of these preliminary trials the varieties selected for the main experment during the period 1906-08 were the Eckendorf, the Small Thuringian and the Dutch marsh beans. According to these experiments the Eckendorf and the Small Thuringian seem to have the same value as to productivity under favourable conditions of growth. The Small Thuringians require less water than the others and therefore thrive better in dry years and on dry soils. Under less favourable conditions the Dutch marsh bean is a valuable variety, at least equal to the Eckendorf, and superior to the Small Thuringian.

The Halberstadt bean was substituted for the Dutch marsh bean in the main experiment during the years 1909-12. The results of this period agree with those of the previous one, inasmuch as the Small Thuringians in dry years prove superior to the Eckendorf beans. The Halberstadt have revealed themselves as fairly productive, but require more moisture than the Small Thuringians. The yields of the several varieties, as well as those

of each year and the averages for both periods of experiment, are collected in tables. As the value of a variety does not depend only upon the yield, but also upon other useful characters such as the composition of the crop, and resistance to plant diseases and to lodging, observations on these qualities also were made during both experiments. With the help of these results any farmer can easily find out which are the most suitable varieties for his farm.

Together with the determination of the agricultural value of the several varieties, experiments were also made as to the effect of sulphate of copper against leaf aphids. As an appendix, a table containing results of this treatment on the yields of grain and straw of several kinds of beans is attached to the report. On the Eckendorf, Dutch and native seeds the copper sulphate treatment was injurious to the yield of pulse and of straw; in all cases. With the Small Thuringians and Halberstadts the yield was in some instances higher than on the plots which had not been treated.

231 - **The Tepary, a New Cultivated Legume from the South-West States.** — FREEMAN, G. F. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 395-417 + figs. 1-11. Chicago, November 1913.

The writer describes a new bean occurring in the south-west of the United States. On account of its resemblance to *Phaseolus acutifolius* Gray and its larger dimensions he proposes to call it *P. acutifolius* var. *latifolius*. It is grown by the Indians and Spanish settlers throughout Arizona and northern Sonora and is noted for its drought-resistant qualities. The seed has a high specific gravity (1.33) and absorbs moisture very rapidly, thus enabling it to germinate during the short periods of rainfall of arid climates. It yields a gelatinous extract in water and is much prized by Mexicans and Indians in the preparation of soups.

ROOT CROPS.

232 - **Mutations of Tuberous Species of *Solanum* produced under Cultivation** (1). — HECKEL, E. and VERNE, C. in *Bulletin des Séances de la Société Nationale d'Agriculture de France*, Vol. LXXIII, No. 8, pp. 612-628. Paris, October 1913.

This article is an account of the results obtained in culture experiments with several tuberous species of *Solanum* collected by Claude Verne in the Cordillera (Chile, Peru, Bolivia) in 1911. The experiments were conducted at the Botanic Gardens of Marseilles and Montpellier and in horticultural establishments at Gières and St. Martin d'Uriage.

The following species gave rise to mutations under cultivation.

Solanum immite. — The mutants consist of round yellow tubers of good appearance, which develop early, producing a haulm of a distinct type, resistant to *Phytophthora*.

S. Jamesii. — This species resisted the effects of good cultivation for three years, but later with heavy dressings of poultry manure produced a new kind of tuber, yellow in colour, round in shape, with soft flesh and

(1) See also: No. 2560, *B.* Aug.-Sept.-Oct. 1911; No. 68, *B.* Jan. 1912; Nos. 23 and 24, *B.* Jan. 1913; No. 655, *B.* June 1913. (*Ed.*)

without prominent lenticels. No change has taken place in the characters of the haulm, since they agree with the description given by Baker in 1884.

S. tuberosum. — This species responds very readily to treatment and gave rise to mutations in both tubers and haulm in the first years. Plants grown from tubers from different sources (Bolivia and Peru) have been described by Bitter as belonging to two new species, *viz. S. acaule* and *S. medians.* The author agrees with Weddel and Dunal in regarding the former as an alpine form of *S. tuberosum* and as a result of his experiments proposes to describe it as var. *caulescens.* This subspecies shows great promise. It produces a luxuriant haulm of a height of 3 feet or more and during a severe outbreak of *Phytophthora* when all types of *S. Commersoni* and *S. Maglia* and the wild *S. Bitteri* were badly attacked, this species remained perfectly healthy during August and September, in spite of warm rainy weather.

S. Maglia. — Incomplete mutation took place in this species. Numerous tubers were produced of a deep violet colour with streaks of yellow. A considerable shortening of the stolon took place, and in some the lenticels were less prominent.

S. Commersoni. — Five tubers of a new type were obtained at Montpellier. They were of a greyish yellow colour and produced plants more resistant to *Phytophthora.* Samples were exhibited at the show of the " Société viticole et horticole du Beaujolais ", at Villefranche-sur-Saône, in August, and they appear to have entered into cultivation in this district.

S. Bitteri. — This species shows little tendency to produce mutations. Transplanting it from Marseilles to St. Martin d'Uriage appeared to have no effect on the stability of its characters. Some of its tubers have shown a slight tendency to form areas with fewer lenticels. The tubers are yellow on lifting, but turn a deep violet colour on exposure to the air.

The writer does not agree with the theory that *S. tuberosum* is the only possible origin of the cultivated potatoes of the world, nor with the belief of many botanists that the numerous wild tuberous species of *Solanum* are incapable of the cultural modifications undergone by the ordinary cultivated species.

233 - **The Artificial Ripening of Cotton.** — *The Textile World Record*, Vol. XLVI, No. 3, pp. 64-65. Boston, December 1913. FIBRE CROPS.

The question of ripening is one of the most important in the cultivation of cotton. An American inventor seems to have found a process for ripening cotton by artificial means, which would allow all the bolls being gathered at one picking. L. De Costa Ward, of the Philadelphia Textile School, has tested bolls matured naturally and others artificially by the Hall process. They showed practically the same length of staple in both cases, with the artificially matured fibres possessing greater strength. The seed from the bolls was tested by M. J. Williams, Government chemist, who reports that the oil and fat in the artificially ripened seeds was 2.32 per cent. higher than in the naturally ripened ones.

234 - **Experiments in Hungary with Hemp Seed from Asia Minor and from Italy.** — GASZNER, KÁROLY in *Közlelek*, Year 24, No. 4, p. 84. Budapest, January 10, 1914.

During the last three years the writer has conducted a series of comparative experiments with two varieties of hemp: one from Turkey-in-Asia, the other from Italy (Bologna). Of both varieties 62 lbs. per acre were sown in rows $4^3/_4$ inches apart on several fields of 57 to 72 acres in area. The two varieties were sown at the same time and under similar conditions. In the Asiatic variety germination began 8 or 9 days after sowing, in the Italian 2 to 3 days later. The Asiatic hemp showed a more rapid development than the Italian, its stalk became thinner and more flexible and at the approach of flowering time it turned light green, whilst the Italian hemp kept its dark green colour to the end. On August 1, at the beginning of the harvest, the Asiatic hemp was about 6 inches taller than the Italian and in spots where the soil was most suitable it attained 10 feet in height. The result obtained from the two varieties showed also some difference: in 1912 the crop of Asiatic stalks was 186 lbs. per acre in excess of the Italian, and in 1913, 288 lbs. (The average quantity of hemp harvested in 1912 was above 83 cwt. per acre). The difference in the yield of the two varieties may be attributed to the denser germination of the Asiatic hemp.

From these experiments the writer draws the conclusion that for the soils of Hungary, Asiatic hemp is more suitable. Its stalk becomes taller and it yields a finer and longer fibre, more suitable for the textile industry than the Italian variety. Nevertheless, the Asiatic seed has not yet been selected, as attention has only recently been paid to it. This is a task for the recently created Royal Hungarian Institute for the Cultivation of Flax and Hemp.

OIL CROPS

235 - **Some New or Little-known Oil Seeds and Oils.** — *Bulletin of the Imperial Institute*, Vol. XI, No. 4, pp. 559-574. London, October-December 1913.

Safflower (*Carthamus tinctorius* L.) has been grown experimentally in Nyasaland; a sample of its seeds received for examination was quite similar to the Indian safflower seed of commerce. It yielded 29.6 per cent. of oil. Submitted to valuation by experts it was reported about equal in value to the Indian seed.

Amoora Rohituka W. and A. (Meliaceae) is found in Northern and Eastern Bengal and Assam. The seeds yielded 42.5 per cent. of a viscous clear yellow-brown oil, with an unpleasant smell and bitter taste. On examination it gave the following results:

Specific gravity at $\frac{15.5^\circ\ C}{15.5^\circ\ C}$	0.930
Solidifying point of fatty acids	32.4° C
Acid value	24.7
Saponification value	192.3
Iodine value *per cent.*	131.7

This oil could be used for soap making, but its flavour and acidity render it unsuitable for edible use. The residual cake would be useless for

feeding cattle on account of its taste, and of very little value as manure. In April 1913 the seed was valued at about £ 9 per ton in the United Kingdom.

Eruca sativa Mill., is a Crucifer extensively cultivated in India. The seeds examined yielded 30.8 per cent. of clear yellow oil with a slightly mustard-like smell and taste. The following are the results on examination:

Specific gravity $\frac{15.5^\circ\ C}{15.5^\circ\ C}$	0.915
Acid value	2.4
Saponification value	175.7
Iodine value . . . . *per cent.*	101.6

This oil could probably be used for the same purposes as rape and colza oils.

Samples of Calophyllum Inophyllum seeds and kernels from India yielded from 55 to 71.4 per cent. of oil according to the drier or moister condition of the samples. The oil is viscous, greenish yellow, semi-solid at ordinary temperatures. The results of examination were the following:

Specific gravity $\frac{100^\circ\ C}{15.5^\circ\ C}$	0.880
Solidifying point of fatty acids	36.3° C
Acid value	45.9 to 77.5
Iodine value . . . . . . *per cent.*	93.1 to 97.7
Saponification value	192.8 to 202.9

The oil is of excellent quality for soap making, but would be useless for edible purposes if the acid value were as high as in the present samples; if the fresh seeds or kernels were shipped and handled quickly this might perhaps be avoided. In April 1913 the kernels were valued at £ 16 per ton in the United Kingdom. The residual cake, probably only suitable for manure, might be worth about £ 2 per ton.

Kernels of *Mesua ferrea* seeds from India yielded 73 to 76 per cent. of oil, corresponding to 46 to 49 per cent. from the whole seed. The constants of the oil were as follows:

Specific gravity $\frac{100^\circ\ C}{15.5^\circ\ C}$	0.932
Solidifying point of fatty acids	30.5° C
Acid value	16.2
Saponification value	204.9
Iodine value . . . . *per cent.*	92.2

This oil could be used for burning or lubricating and probably for soap or candle manufacture. It appears that the cake cannot be utilized as a feeding stuff. It would be preferable to export the kernels and not the entire seeds, as the shells are of no commercial value and only increase the

cost of transport. The kernels are worth £ 17 to £ 18 per ton in the United Kingdom.

Illipe oil from the kernels of *Bassia latifolia* from Mauritins differs somewhat from that from Indian kernels, but it yields a good hard yellow soap and for this purpose could realise about the same price as good palm oil.

Pentadesma butyracea is known as " butter or tallow tree " in Sierra Leone. Kernels from the Gold Coast and from Southern Nigeria showed very unequal quality. Consequently, for exportation, only mature kernels should be collected and they should be thoroughly dried in the sun before being shipped. The fat is stated to be highly coloured and to need refining before it can be used to advantage in soap making. The kernels would probably be worth £ 8 to £ 10 per ton in the United Kingdom.

236 - **Some New Tropical Oil Seeds.** - HEBERT, A. in *Journal d'Agriculture tropicale*, Year 13, No. 150, pp. 358-362. Paris, December 1913.

West Africa. — The fruits of *Pentadesma leucantha* A. Chev. contain 5 to 10 ovoid seeds each weighing about 20 grams. These seeds, when crushed and treated with benzine, yield about 50 per cent. of a fatty substance, the constants of which have not yet been determined.

An undetermined species of *Carapa* (Meliaceae) produces a seed containing a kernel weighing about 5 gms. and about two-thirds of the whole seed. These crushed kernels yield, on extraction by benzine, 38 per cent. of fat; this is yellowish white, and melts at 21° C. Its density when melted is 0.913 and its constants correspond to those of a slightly drying oil; owing to its advantageous yields, it might be put to the same uses as most of the vegetable butters.

The fruits of *Sorindeia oleosa* A. Chev. contain in their kernel a browinish fat; its density is 0.889 at 17° C.; it melts between 16 and 17° C. and resolidifies between 12 and 13° C; its constants approach those of oils possessing a certain degree of drying properties, and it could be utilized.

The kernel of *Lophira procera* represents about 75 per cent. of the seeds, which average 0.83 gm. each; these kernels yield more than 55 per cent. of a consistent cream-coloured fat, which is especially suitable for the manufacture of soap. The seeds of *Lophira alata* yield less (40 per cent.) of a similar fat. The cakes are not utilizable as food for live stock on account of their bitter and astringent taste. For the manufacture of soap this fat is said to be equal in value to palm oil.

Madagascar. — Two Clusiaceae, *Symphonia leavis* and *S. Louveli*, studied by MM. Jumelle and Perrier de la Bathie, yield seeds containing a certain proportion (35 to 40 per cent.) of a dark yellow fat, of pasty consistence; its density is between 0.872 and 0.879 at 20° C. and it melts at 15 to 16° C. Its high oleic acid content (60 per cent.) indicates its possible use in the manufacture of soap, and the high melting point (55° C.) of the mixture of solid acids renders it suitable for stearine works. These seeds thus present much interest from the point of view of their industrial utilization. Unfortunately the number of trees which produce them tends to diminish in consequence of the continuous deforestation of the eastern slope of Madagascar.

237 - ***Acrocomia sclerocarpa* and Gru-Gru Oil** [1]. — KNAPP, A. W. in *The Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 1, p. 9. London, January 15, 1914.

The writer describes *Acrocomia sclerocarpa* as a tree belonging to the coconut palm family. Its trunk is generally swollen in the middle and has circles of sharp spines at intervals, thus making it impossible to climb. The leaflets are thinner than those of the coconut palm and the leaves are said to possess a very delicate fibre. The fruits are oblate spheroid in shape, about the size of a large plum and dark green in colour. The skin is very tough, but if the fruits are allowed to fall to the ground, this rots off, leaving the nuts behind, the kernels remaining sweet. The shell of the nut is about $^1/_8$ inch thick and hard ; the kernel ($^5/_8$ inch across) has the appearance and flavour of coconut, but is tougher and more transparent.

Fruit: length 1 ½ inch, breadth 1 $^3/_4$ inch, weight 30 gms., pericarp 59.73 %, shell 31.30 %, kernel 8.97 %. The pulp of the pericarp yields 2.44 per cent. of dry ether extract.

The kernel contains :

	per cent.
Fat (petroleum-ether extract)	49.13
Water	8.14
Albuminoids	13.70
Fibre and unestimated	29.03
	100.00

One tree bore nine large bunches, each containing about 400 fruits. The kernels were collected in March and on pressing when hot yielded an oil having the following properties (table, p. 364).

The writer concludes that this oil is identical withMocaya oil of Paraguay and the oil from the maccasuba palm of Surinam. It is very similar to coconut and palm-kernel oils in both organoleptic and analytical tests, consisting chiefly of laurin and myristin. It contains about 12 per cent. more olein than coconut oil, and hence should have about the same value as palm-kernel oil. Its soap is almost white and has excellent lathering properties, while the " stearine " should make a good edible fat.

Though the tree is widely distributed in the West Indies and South America, and appears to grow on the poorest soils, large quantities of the kernels and oil are difficult to obtain.

(1) See also No. 28, *B*. Jan. 1914. (*Ed.*)

	Oil	Insoluble fatty acids
Colour	very pale yellow	white
Odour	like coconut oil	like coconut fatty acids
Taste	ditto	ditto
Specific Gravity $\left(\frac{99^\circ C.}{15.5^\circ C.}\right)$	0.861	0.838
Melting point	26.0° C	24.0° C
Titer	—	23.05° C
Iodine value (Wijs)	19.4	20.3
Refraction at 40° C.	36.95	19.7
Saponification value	243.5	—
Reichert-Meissl value	7.2	—
Polenske value	13.9	—
Shrewsbury and Knapp value	163.0	—
Neutralisation value	—	261.9
Mean molecular weight	—	214
Free fatty acids (as oleic)	0.62 %	—

238 – **Baobab Fruits and Seeds from the East African Protectorate.** — *Bulletin of the Imperial Institute*, Vol. XI, No. 4, pp. 583-586. London, October-December 1913.

The low oil content of baobab seeds does not allow them to be exported to Europe, but they can be used on the spot as food for live stock by softening the integument by boiling. They contain 3.5 per cent. of mineral matter, and their ash, which is rich in potash (31. per cent.) and in phosphorus pentoxide (34.2 per cent.), may be utilized as manure.

The husk of the fruit may be used as fuel, and its ash is a rich potash manure (47 per cent. of potash).

Though the pulp contains a certain amount of free citric acid, the extraction of this is not remunerative on account of the presence of a good deal of pectic substances. The pulp does not seem to be utilizable beyond the colony, where it is used to coagulate rubber.

239 – **Contribution to the Study of *Hibiscus cannabinus* L.** — VUILLET, J. in *L'Agronomie coloniale*, Year 1, No. 6, pp. 161 163. Paris, December 1913.

This paper contains the results of the examination of seeds of *Hibiscus* as to their oil content. Owing to the difficulty of husking, the analysis was made on the whole seed. It yielded the following results:

Water	9.64
Mineral matter	6.40
Fat	20.32
Proteids	21.14
Saccharifiable matter	15.66
Crude fibre	12.90
Undetermined	13 94
	100.00

Another sample contained only 17.14 per cent. of fat.

The fat is a drying oil of a light yellow colour. It appears that it could find application in the colour and varnish industries. As the seeds can be fed to poultry without ill effects, it is believed that the cake could be used as food for live stock. The average yield of an acre of "Da" (the Somonos name for this plant) in the Niger valley is about 450 lbs. of seed.

240 – **Utilization of Para Rubber Seed.** — *Bulletin of the Imperial Institute*, Vol. XI, No. 44, pp. 551-559. London, October-December 1913.

Oil. — Para seed oil is a drying oil which dries less quickly than linseed oil, but when the latter is high in price it could be substituted advantageously by Para seed oil. Submitted to several industrial firms, the oil has shown itself suited to various purposes. For soap making it has about the same value as cottonseed oil.

Cake. — Two series of feeding trials have been carried out with Para rubber seed cake and its value as a food for cattle has been clearly established; in general the animals seemed to relish it. The composition of Para rubber seed cake is not very dissimilar from that of linseed cake, the difference being in favour of the former as is shown by the following table.

	Para rubber seed cake — Per cent.	Linseed cake — Per cent.
Moisture	6.91 to 8.75	11.6
Crude proteins	29.93 » 30.19	29.50
Fat	8.71 » 17.68	7.50
Starch, etc. (by difference)	35.97 » 41.74	35.54
Fibre	4.82 » 5.01	9.10
Ash	4.69 » 5.60	5.20

241 – **Experiments on Tapping Manihot.** - ZIMMERMAN, A. in *Der Pflanzer*, Year 9, No. 12, pp. 585-597. Daressalam, December 1913. RUBBER, GUM AND RESIN PLANTS.

I. — *Frequence of tappings of Manihot Glaziovii.*

1. *Experiments at Inuhesa.* — The trees of the Inuhesa Rubber Estates were divided into four lots and tapped at different intervals: Lot I twice a week, lot II once, lot III once every two weeks, and lot IV every four weeks. In order to facilitate the study of the yields, the experiments were divided into periods of about 7 weeks (7 periods per year). The average girth of the trees was about 21 inches.

If the accidental variations due to climate are neglected, the table shows the superiority of the yields obtained during the first year by means of two tappings a week (lot I), but at the same time it shows the progressive weakening of lot I in consequence of the too frequent tapping, whilst lot IV shows a gradual increase of its yield.

According to the figures obtained during the beginning of the second year of experiment the writer has calculated the probable yield in grams for the year (Table II).

TABLE I. — *Yield of moist rubber, in grams per tree per period.*

Period	Lot I	Lot II	Lot III	Lot IV
1	105.8	49.8	22.4	10.4
2	76.4	48.0	22.9	12.3
3	50.6	37.7	26.4	11.6
4	55.1	40.2	19.4	12.9
5	66.6	38.6	23.4	12.1
6	80.5	42.7	27.6	14.0
7	32.0	21.3	13.6	14.0
Total of first year	467.0	278.3	155.3	87.3
8	68.9	41.8	30.6	16.5
9	65.1	43.3	29.1	15.5

TABLE II.

	Lot I	Lot II	Lot III	Lot IV
Yield per tree during 1st year	467.0	278.3	155.3	87.3
Yield per tree during 2nd year	296.4	250.9	212.9	138.3
Average yield per tapping per tree during the first year	4.34	5.35	5.97	6.72
Average yield per tapping per tree during the 2nd year	2.85	4.44	7.65	10.64

One important fact in favour of not too frequent tapping is the superiority of the average yield per tapping observed in lot IV during the first year.

2. *Experiments at Amani.* — The trees, four-and-a-half years old and averaging 20 to 22 inches in girth, were divided into three groups tapped as follows: Lot I twice a week, lot II once, lot III once every two weeks. Table III has been prepared like Table II.

TABLE III.

	Lot I	Lot II	Lot III
Yield in grams for the 1st year	460.8	330.2	183.9
Yield in grams for the 2nd year	218.0	317.2	231.4
Average yield per tapping per tree for 1st year	4.5	6.4	7.1
Average yield per tapping per tree for 2nd year	2.1	6.1	8.9

The Amani experiments confirm those of Inuhesa: Trees tapped 104 times a year gave yields showing a considerable progressive diminution. From these experiments it appears that the number of 26 tappings per annum will give the best results for a long period, but only time will show if this expectation is justified.

II. *Influence of the distance between the trees on the yield of latex.*

The following yields of moist rubber per tapping per tree were obtained at various distances of planting.

	gms.
5 × 5 m. (16 ft. 8 in, × 16 ft. 8 in)	5.6
5 × 2.5 m. (16 ft. 8 in. × 8 ft. 4 in.)	3.9
2.5 × 2.5 m. (8 ft. 4 in. × 8 ft. 4 in.)	3.3
2.5 × 1.25 m. (8 ft. 4 in. × 4 ft. 2 in.)	2.1

On equal areas, the close-planted trees yield most up to the present.

242 - **Purchases of Tobacco made by the State Monopoly in Hungary in 1912.** (1) (Extract from the publication of the Central Direction of the State Monopoly in Hungary) in *Volkswirtschaftliche Mitteilungen aus Ungarn*, Year VIII, Part XII; pp. 1260-1266. Budapest, December 1913. VARIOUS CROPS

In 1912, 10787 Hungarian tobacco growers produced in 940 communes, on an area of 133 256 acres, 150 581 500 lbs. of tobacco of 12 different kinds, of which 149 211 500 lbs. were utilizable. The total cost of purchasing this quantity of tobacco was £ 1 239 407, namely £ 1 212 651 price paid for the tobacco, £14 076 for transport and £ 12 679 expenses for delivery, etc.

The returns of the different kinds of tobacco are as follows:

	lbs
Wrappers for cigars	28 334
Tobacco leaves	36 584 000
Szeged tobacco	21 578 000
Debreczen »	62 323 250
Szutok »	2 968 150
Common garden leaves	3 739 900
Fine » »	163 530
Demi-fine » »	7 938 700
Debrö garden tobacco	174 200
Muskatály of Szentandrás variety	401 300
Muskatály tobacco	94 720
Knaster tobacco	13 217 350

The quantity of foreign tobacco imported in 1912 was 10 821 400 lbs. worth £ 642 173.

243 - **The Relation between an Abundant Rainfall and the Production of Coffee.** - PESTANA, PAULO R. in *Secretaria da Agricultura, Commercio e Obras Publicas do Estado de Sao Paulo, Boletim da Directoria de Industria e Commercio*, Series 4, No. 7, pp. 267-272. São Paulo, 1913.

The writer points out a direct, though not exclusive, relation between the rainfall during the months October to March and the yield of coffee in the

(1) See No. 800, *B.* May 1912; No. 1261, *B.* Nov. 1913. (*Ed.*)

Rainfall			Yeld of Coffee	
Season		mm.	Year	Arrobas
I – *Ribeirão Preto*				
1904–05	October-March	1 573	1906–07	3 261 500
	April-September	270		
1907–08	October-March	905	1909–10	2 497 742
	April-September	196		
1908–09	October-March	896	1910–11	2 316 154
	April-September	293		
1909–10	October-March	1 209	1911–12	2 540 230
	April-September	229		
1910–11	October-March	753	1912–13	2 100 000
	April-September	358		
II – *S. Carlos do Pinhal*				
1904–05	October-March	1 950	1906–07	2 214 550
	April-September	511		
1907–08	October-March	1 595	1909–10	1 601 472
	April-September	321		
1908–09	October-March	2 170	1910–11	* 1 328 160
	April-September	471		
1909–10	October-March	1 459	1911–12	1 403 300
	April-September	523		
1910–11	October-March	1 061	1912–13	1 232 314
	April-September	390		
III – *Botucatú*				
1904–05	October-March	1 124	1906–07	1 026 600
	April-September	402		
1907–08	October-March	1 103	1909–10	765 350
	April-September	201		
1908–09	October-March	863	1910–11	493 140
	April-September	211		
1909–10	October-March	971	1911–12	668 260
	April-September	165		
1910–11	October-March	842	1912–13	510 000
	April-September	477		

* It must be noted that the coffee plants still showed the exhausting effects of the high yield of 1906-07.

season two years later. The same relationship has already been observed in Costa Rica. The figures in the table are those of the three principal coffee-producing centres in the State of São Paulo. The grouping of the months into two periods corresponds to the climatic conditions of the State and to the biological conditions of the coffee plant. October is the beginning of frequent rains, which reach their maximum in December and January and diminish towards the end of March. In April begins the cold dry season during which the coffee is harvested, and this terminates in September. Rains during the hot season favour the flowering the following year and the fruiting of the second year, but during the cold season they are injurious.

244 - **The Selection of Tea.** — BERNARD, CH. und VAN LEERSUM, P. in *Mededeelingen van het Proefstation voor Thee*, No. XXVI, 15 pp. + 4 plates. Buitenzorg, 1913.

Disinfection and selection. — The writers have just perfected a method for disinfecting the seeds of the tea plant and separating those possessing only a low germinative power. The disinfection is accomplished by means of 1 a per thousand solution of corrosive sublimate, and its chief object is to preserve Java from two pests which do not yet exist in the island, but which cause damage in British India : *Exobasidium vexans*, which produces blister blight, and and the green fly (*Chlorita flavescens*).

The seeds after being taken out of the corrosive sublimate bath are plunged into pure water with the object of washing them and separating those that float and which form class (*a*). The seeds that are heavier than water are then placed in a 25 per cent. solution of sugar : some float (*b*) and the others sink (*c*). After the sugar bath also the seeds are washed again in pure water.

The (*a*) seeds have a low germinative power ; they are put into a germinator and those which sprout are added to the (*b*) seeds, which are sown in a nursery ; then the most vigorous plants are selected. As for the (*c*) seeds, the best, they may be sown at once where they are to remain. This method is very rapid, simple and economic, and it has given excellent results.

Grafting. — In order to improve the quality of existing plantations, the writers have devised a method of grafting which gives 70 per cent. of successful grafts, and this with still inexperienced hands. The stock must be between 3 and 5 years of age and the best time for the operation is the beginning of the rainy season. The graft that has yielded the best results is one in which a T-shaped incision is made in the bark of the stock. The scion is a strong shoot bearing three or four buds and somewhat lignified at its base ; its lower extremity is cut to a bevel about 1¼ inch in length, and inserted into the T-shaped incision, the sides of which are then drawn together and the whole is carefully bound.

The question of decorticating the tea seeds used for sowing is not completely settled ; it seems, however, that it is preferable to crack the tegument without removing it from the grain.

245 – ***Suaeda fruticosa* for the Fixation of Shingle Beaches.** — OLIVER, F. W. in *The New Phytologist*, Vol. XII, No. 9-10, pp. 357. London, December 1913.

The writer recommends *Suaeda fruticosa* as the most effective stabiliser of all British shingle plants, in virtue of its shrubby habit of growth and high capacity for rejuvenescence.

FRUIT GROWING.

246 – **The Nursery of American Vines in The Tremiti Isles (Adriatic). – Its History and the Results obtained.** — *Communication from the Italian Ministry of Agriculture, Industry and Commerce.*

The discovery in France of the possibility of protecting vineyards from phylloxera by using American stocks led the Italian Ministry of Agriculture to take up the cultivation and distribution of these stocks.

During several years, many kilograms of seed of American vines were distributed among the institutes and vine-growers, and numerous nurseries and important vineyards of stocks were installed in the various districts of Italy. Seed of typical Riparia was first distributed, and later seed of Rupestris and Berlandieri.

Thus up to 1883 the phylloxera-free regions contained four larger nurseries, which supplied vineyards for the production of Riparia seed, namely: one at Rome entrusted to the Royal Practical Agricultural College; one at Parma under the direction of the Royal Agricultural Station; one at Asti, directed by the Royal Oenological Station; and the last at Acireale, under the immediate control of the Agricultural Committee of Acireale.

Nurseries and vineyards of Riparia (type), Rupestris and Berlandieri were then instituted, on a smaller scale, at the special schools of viticulture and oenology and the majority of the schools of practical agriculture. Others again were instituted at the above-mentioned schools and other practical schools with rooted cuttings of American stocks already cultivated in Italy, namely York Madeira, Solonis, Vialla, Taylor, Oporto, Clinton, Concord and Jacquez.

These varieties, however, though at first considered the most suitable for the reconstitution of vineyards, soon lost favour with the growers, owing to the discovery, during continued and extensive experiments carried out in different districts in France, of new stocks resistant to the pest and more suitable from the point of view of cultivation. It thus became necessary to provide for their cultivation and distribution.

It was to supply this need that an attempt was made to establish a nursery of American stocks on the island Montecristo (Tuscan Archipelago) with material bought in France and previously disinfected. Unfortunately, this important attempt came to nothing, as only a year after its establishment, phylloxera was observed in a small portion planted with rooted cuttings, and the Ministry of Agriculture, on the advice of the Consultative Antiphylloxera Commission, decided to destroy without delay all the vines which had been imported to Montecristo, and which were already growing vigorously.

Further, the vineyards first reconstituted with material obtained from seed immediately showed many drawbacks to the system. As it was easy to foresee, the nurseries of stocks (not excluding Riparia) contained a mix-

ture of a large number of varieties, of which many were unhealthy and predisposed to fungus diseases. As to the more vigorous varieties, their suitability for cultivation and their resistance to phylloxera were not yet known. These disadvantages were to some extent obviated by a vigorous selection in all the seed nurseries and by opportune researches on the resistance and suitability for culture of the selected plants.

In order, however, to obtain some information from the above experiments, it was necessary to wait a considerable time, while in some important vine-growing regions in Italy phylloxera was already widely spread and the need of providing for the reconstitution of the lost vineyards was urgently felt. Consequently the Ministry of Agriculture decided not to limit the material available to that supplied from the above mentioned nurseries (in order not to place growers in the infested regions of Italy at a disadvantage to foreigners from the point of view of the reconstitution of their vineyards) and consented to the importation from France, with all the necessary precautions, into the infected regions where they had abandoned the protection of vineyards by destruction, of American stocks which showed more promise of success than those already in Italy. In this way the nurseries of American stocks already mentioned came to be planted in various regions of Italy, and more particularly in Sicily, Sardinia and Elba, where the insect had caused considerable damage.

In 1900, an attempt was again made, this time in the Tremiti Islands, where the starting of a nursery of American vines has been a complete success.

The task of providing for their installation was entrusted to Dr. Leobaldo Danesi, who on two occasions selected the necessary material in France, and took a considerable portion from the Royal Nursery of American vines at Portoferraio.

The Island of San Donnino, about 16 miles from the Apulian Coast, was chosen as being the most suitable of the Tremiti Islands for this purpose; it is the largest of them, having an area of 214 acres. Climatic conditions there approach those of the adjacent coast. Rain is infrequent, and drought continues every year from April to September. The winter is mild and the summer rather hot, but rapid changes are frequent at all seasons, and sharp falls of temperature occur when the north wind blows.

The nursery is at Don Michele, where the soil is a calcareous loam, with subsoil, in places of calcareous tufa and in places of compact limestone, occurring at a depth varying between 20 and 24 inches or even more. Considering its origin, the surface soil is not remarkably rich in calcium carbonate, which reaches 16 per cent. only in some places.

The land was bastard trenched right across to a depth of 2ft. 6 in. During the first year (1900) the nursery covered an area of 5 $^3/_4$ acres; this was increased in the following years and now reaches 25 acres.

The vines selected were those species and varieties which had given the best results in the trials so far made in Italy, all being stocks except a single hybrid direct-bearer. Preference was given to those suitable for calcareous soils and the southern regions of Italy, which are liable to prolonged drought

In 1904 other stocks were added and a large number of direct-bearers favoured by the French growers, so as to have a supply of this material for the cultivation experiments necessary in the different regions of Italy.

The attached table indicates the number of stocks and direct-bearers grown.

	No. of existing plants	Vines grafted for trial of affinity with the stock	Vines for the production of cuttings
Stocks	40 460	1 067	39 393
Direct-bearers	3 033	—	3 033
Total	43 493	1 067	42 426

Only cuttings were used for planting, and they were taken from very vigorous stocks free from fungus disease. They were examined one by one and all showing any lesion or any sign suggesting presence of disease were rejected. All were then disinfected at Portoferraio by immersion for five minutes in water at 55° C., the temperature scarcely falling 1° and seldom reaching 51° at the time of extraction.

The cuttings thus treated were immediately packed with all care and despatched to the Tremiti Islands. On arriving at their destination they were immersed in a 1 per cent. copper sulphate solution and then planted with a forked stick, the holes being carefully filled in with a thick paste of sand and fine earth. They were planted at a distance of 5ft. each way.

To ensure the striking of the cuttings of Berlandieri and of certain rare varieties, they were grafted onto well-rooted cuttings from a locality absolutely free from phylloxera. To obtain a large number of shoots the first year, 2372 Italian plants in the Giovanella vineyard in the neighbourhood of the nursery, in good condition of growth, were grafted with the principal American stocks. The grafts were made low down so that they might root. The layering was next carried out in such a manner that the same distance was left between each plant as between those in the nursery.

For six years from 1910 the plants were rigorously inspected, with negative results. In spite of all precautions taken in the choice of material the first symptoms of "bramble-leaf" (roncet) appeared during 1903 among some Riparia Rupestris and Rupestris du Lot; in the following years other plants developed the disease. However, the rapid spread of the disease was checked each year by eradication of the diseased plants and those close to them. Further, in order to effect a rigorous selection, the Ministry of Agriculture sent two specialists in September 1912 to examine with every possible care the entire nursery; they destroyed 223 plants which they considered affected with "bramble-leaf" or suspected. Most of the diseased vines occurred in the Giovanella vineyard where grafts had been made on Italian stocks and then layered. It should be noted that this vineyard is on

rather heavy soil on a steep slope facing north, and is thus subject to considerable variations of temperature.

The first distribution of material was made in 1903 with shoots from three-year-old vines. It was not until 1904-5 that the whole 25 acres was planted with stock-vines. Since then the production has varied in normal years between a million and a million and a half of cuttings of various sizes. This material has been chiefly distributed among societies for protection against phylloxera, numerous agricultural institutions controlled by the Ministery of Agriculture and where possible to private growers.

The societies have established, with material from the Tremiti Is., nurseries of stock-vines covering an area of over 815 acres, capable of an annual production of about 40 million cuttings of various sizes. They have also planted nearly 215 acres of rooted cuttings and established more than 300 vineyards for experiments and demonstrations.

The other institutes have also established new nurseries and transformed seed nurseries by grafting. Perhaps in some places this transformation has been somewhat premature, resulting in the abandoning of certain seedlings produced under conditions very different from those of our vine regions, which might have been more valuable than the ones mentioned; there is now a tendency to take up the study of some of these again.

Besides the establishing of the stock nursery, various other experiments which may be worth describing have been carried out in the Tremiti Islands.

The principal American stocks have been grafted with the better local Vinifera varieties, such as Trebbiano, Sangiovese, Malvasia, Galoppa and Tokay, and a very careful account has been made of the growth of the grafts, their production, and the quality of their produce, etc., so as to obtain practical knowledge of their binding with the stocks in question.

Every year hybrids have been made among the different American varieties and between them and the above-mentioned Italian ones. Selection of the seedlings was made in the seed-bed and those which showed by their morphological characters that they were not hybrids, were rejected. The selected seedlings were then sent to the experimental vineyards of Cassano and S. Michele in the province of Bari, where their resistance to phylloxera is being tried. Some plants already give hopeful results.

The fruit and musts obtained from the direct bearers have been analysed each year, and also the products from the grafted vines, to determine the influence of the stocks on the quantity and quality of the product. Results of some importance have been obtained, and will be published shortly.

Numerous experiments have been made on the disinfection of vines and their resistance to hot water. Dr. Danesi has given an account of these researches and other experiments made elsewhere in various papers, some of which were published in the *Atti dell'Accademia dei Lincei*.

Thus we may conclude that the nurseries of American stocks in the Tremiti Islands have supplied a veritable need of Italian viticulture and have completely attained the object for which they were established.

247 - **The Composition of Irrigated and Non-Irrigated Fruits** (1). JONES, J. S. and COLVER, C. W. in *Idaho Agricultural Experiment Station, Bulletin* No. 75, pp. 1-53. Moscow, Idaho, August 1912.

It is a generally widespread belief that irrigated fruits are more liable to decay and possess less flavour than non-irrigated fruits. Since this inferiority is attributed to abnormally high percentages of water and correspondingly low percentages of solid matter, analyses were made of the content of dry matter, sugar, acid and crude protein in various fruits grown under these two systems, with a view to testing the truth of these suppositions. It was not presumed, however, that chemical analyses alone could settle questions relating to quality in fruits.

The material used in these analyses was not obtained from specially controlled plots ; all irrigated samples were grown in districts where climate and soil render irrigation imperative, all non-irrigated samples in idstricts where the annual rainfall varies from 25 to 35 inches and where the soil and topography of the country render irrigation methods impracticable. The comparisons are therefore made between *normal* irrigated and normal non-irrigated fruits.

In the case of drupaceous fruits, analysis shows distinct differences in favour of non-irrigated fruits, especially when the results are calculated on the dry matter ; but they are not considered sufficiently large to seriously affect the taste, except in the case of Italian and Petite prunes.

In the case of apples, the non-irrigated almost invariably contain greater percentages of acid and sugar, but the differences are small and practically disappear when calculated on the total dry matter. Irrigated apples contain a smaller percentage of solids insoluble in water, but in intensity and uniformity of colour, and in percentage of waste, they have somewhat the advantage over the non-irrigated.

Of the small fruits, strawberries alone show any marked difference in composition due to irrigation. When irrigated they are decidedly inferior in dry matter, sugar, acid and crude protein, and they lose their freshness and keeping qualities much earlier. In the case of blackberries and raspberries, irrigation results in an increased percentage of sugar and a decreased percentage of acid when calculated on the total dry matter, and is therefore a distinct advantage in growing these fruits for marketing in the desiccated condition.

In general, it may be said that no marked differences in food and market value of fruits can be attributed to the effects of irrigation.

248 - **The Pollination of the Coconut.** — PETCH, T. in *The Tropical Agriculturist*, Vol. XLI, No. 6, pp. 449-455 + 2 figs. Peradeniya, Ceylon, December 1913.

The coconut tree is monoecious and the flower diclinous ; a period of from 2 to 5 days elapses between the shedding of the last male flower and the opening of the first female flower. Pollination can therefore only be effected by pollen from other inflorescences of the same tree, when the flowering periods overlap, or from the male flowers of neighbouring trees.

(1) See No. 1348, *B.* Dec. 1912. (*Ed.*)

Thus the duration and frequency of the flowering periods is of the utmost importance in determining the degree of fertility of the tree.

From an examination of the structure of the female flower, the writer concludes that pollination is generally effected by bees and hornets and also to a large extent by the wind. Though ants are abundant on the inflorescences, their access to the stigma is prevented by the exudation of a ring of sticky juice from a large number of pores situated on the exposed area below the stigma.

Observations made during 1912-13 on the opening and shedding of flowers showed that, to ensure overlapping, the interval between successive flowering periods should not exceed 30 days, thus necessitating the production of 12 or more inflorescences per annum. The intervals varied between 24 and 58 days, being longest at the beginning of the year and shortest about May and June.

Observations on the shedding of immature nuts gave inconsistent results. Overlapping of the flowering periods was not followed by an increase in the number of nuts retained. Further experiments are necessary to determine the relation of this phenomenon to fertilisation.

249 - **The Flowering of Pears.** — CHITTENDEN, F. G. in *The Journal of the Royal Horticultural Society*, Vol. XXXIX, Part 2, pp. 366-372. London, December 1913.

The writer gives a list of varieties of pear trees under observation at Wisley, arranged in relative order of flowering, and showing what varieties may be expected to be in flower at about the same time each year.

250 - **The Cultivation of Teak in Java.** — SCHAEFFER, G. in *Journal d'Agriculture tropicale*, Year 13, No. 150, pp. 353-356. Paris, December 1913. FORESTRY.

Java possesses at present upwards of 1 480 000 acres of teak forests, and this splendid asset increases every year, as the area reafforested is two and a half times larger than the area felled during the same time; on the other hand teak is nowhere cultivated except in Java. In the island the conditions required for the cultivation to be profitable are a fair soil of at least medium fertility, a minimum of 60 cm. (40 in.) of yearly rainfall and an altitude inferior to 100 m. (330 feet).

Regeneration. — Teak sends up numerous shoots from the stool, but the trees thus obtained being much inferior to seedlings, this mode of regeneration is not utilized. The seeds are sown in holes in rows at 3ft. by 10 ft. Other crops, such as rice or earthnuts, are grown between the rows during the first year.

Maintenance.— The greatest attention of the forester is devoted to preventing alang-grass (*Imperata arundinacea*) from invading the plantation; hoeing being too expensive, *Leucena glauca*, a leguminous plant, is sown between the rows as a cover plant; it chokes the alang and keeps the soil clean; besides which it prevents the leaching out of the soil and enriches it in humus and nitrogen and disappears when the cover of the forest is sufficient.

Felling.— The new artificial forests are still too young to be felled; but it is estimated that the trees will attain a diameter of 24 inches at the age of 80 or 100 years.

LIVE STOCK AND BREEDING.

HYGIENE

251 - **New Investigations into the Life History of the Two Warble Flies of Cattle** (1). — GLASER, HANS, in *Mitteilungen des Ausschusses zur Bekämpfung de Dasselplage*, Part 5, pp. 5-38. Berlin, 1913.

The writer reports upon the continuation of his investigations into the life history of the two warble flies of cattle, undertaken for the Committee for the Control of Warble Flies. Altogether 314 warble flies were bred from 375 mature larvae that had spontaneously left their warbles; of these, 208 were the large *Hypoderma bovis* and 106 the smaller *H. lineata*. In this connection it was found that the issuing of the larvae took place early in the morning and in by far the greatest number of cases while the host animals were standing or walking and only exceptionally while they were lying down; it begins mostly half or three-quarters of an hour after the animal stands up, and is interrupted if the animal lies down again. The writer explains this fact by the difference in the tension of the skin of the cattle.

On the same animal larvae of the large and of the small warble fly may be found. On issuing from the hide they are easily distinguished. The larvae of *H. lineata* are smaller and more slender than those of *H. bovis* and when mature they are gray brown, while those of the larger fly are greenish brown. The colour is a sure test, even when small and slender larvae of the larger fly are found. In general the larvae of the smaller fly are somewhat earlier than the others.

The change into pupa takes place on warm and dry days mostly within 24 hours; in rainy and cold weather the process lasts 2 to 4 days. The larvae of *H. lineata* always require less time for the change than those of *H. bovis*. The pupal stage of the small fly averages 30 days, that is 14 days less than that of the larger fly. In general the males have a shorter pupal stage than the females; thus the latter, on issuing from the pupa, always find sufficient males with which to mate.

The emergence of the flies takes place in the early morning and by preference on fine sunny days; this explains their appearing in large numbers when the wheater is fine. The swarming of *Hypoderma lineata* is for the most part in June, that of *H. bovis* in July.

The deposition of eggs takes place most frequently immediately after mating. Both the small and the large fly generally lay their eggs on the legs, and by preference on the hind legs a little below the hock. Besides this, the writer saw the flies frequently depositing their eggs on the belly of a calf used for experiment. Occasionally a fly would settle on the flanks or breast. No fecundated female ever deposited eggs on the back of the calf. The animal always became very excited on the approach of a female fly, whence the writer concludes that during June and July, and perhaps August, the gadding of cattle is due to warble flies. The fly

(1) See No. 144, *B*. Feb. 1913. (*Ed.*).

causes its eggs to adhere to the hair of the host and the writer observed that the large warble fly sticks only one egg per hair, while the small fly sticks several of them on one hair, as many as 15 having been counted.

The egg of *H. bovis* is larger and more slender and more pointed at the free end than that of *H. lineata*. Further, the stalk which joins the egg of the large fly to the extension that embraces the hair is thinner than in the eggs of the smaller fly. The habit of the small warble fly of laying several eggs on one hair explains the fact that during oviposition it fastens itself more firmly to the hair than the other fly; it holds its ovipositor nearly parallel to the hide of the animal, while *H. bovis* sinks it almost vertically into the hair. The number of eggs that one fly can lay under favourable circumstances was determined by the writer for one *H. lineata*: it amounted to 550.

In the eggs very spiny maggots or bots develop after a few days; they issue from the eggs on to the hide of the animal: the writer assumes that the cattle take up the larvae rather than the eggs.

The writer has also conducted experiments in order to ascertain if the larvae of the two warble flies are able to penetrate into the skin of man and of animals. The result has always been negative as regards cattle, but in man, in one case (on the writer himself), a larva penetrated the skin of the thigh.

Last year for the first time infection experiments could be carried out on six cattle with fecundated eggs and larvae. The results, however, will not be determined till the spring. The writer hopes soon to be able to report upon the most suitable methods of controlling this pest.

252 - **The Natural Infection of Calves with Tubercle Bacilli.** — CHAUSSÉ in *Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 16, pp. 642-644. Paris, October 20, 1913.

The writer submitted to careful examination 56 calves destined for the slaughterhouse and suffering from typical tuberculosis, with the object of ascertaining the principal way by which the tubercle bacillus had entered their bodies. Of the 56 animals, 44 had typical tubercles in the lungs, while all the other organs, including those of digestion, were intact. The infection then must have followed the respiratory canal. Material from the intestinal glands of 11 animals was inoculated into guinea-pigs and produced tuberculosis only in one case. But in this case also it was not certain that the corresponding calf, besides lung tuberculosis, had not intestinal tuberculosis also.

Of the remaining 12 calves, 8 showed decided tuberculosis of the liver and its glands. In these cases, the infection must have taken place before birth, which seems all the more probable as the stage of the disease was much more advanced than in the pulmonary tuberculous calves. The four last calves had severe intestinal tuberculosis and had tubercles in the walls of the intestine and in the mesenterial glands. The tubercle bacillus in these calves had undoubtedly been introduced with their food. In all the calves the glands of the infected organs were much degenerated. The

animals infected before birth showed a more advanced degeneration than those infected by the air or food.

The writer concludes from these investigations that the animal organism has aways the tendency to oppose a local reaction as soon as possible to any local infection with tubercle bacilli. Consequently the development of the disease proceeds somewhat more rapidly in the calf than in mature cattle. Calves take the tubercule bacillus in the great majority of cases from the air. Nevertheless, infection before birth is not unimportant. Infection by means of the food is much rarer than through the blood. In France the writer found in 6000 slaughtered calves only one that had been infected by its food. The reason of this may partly lie in the fact that the herds of cows are relatively only very slightly affected by tuberculosis. In pigs, this kind of infection is naturally much more frequent, owing to their very varied food. In 169 pigs that were slaughtered the writer found one animal that had taken the bacillus with its food.

It can therefore be assumed that cows' milk is only in the rarest cases the cause of human tuberculosis.

253 – **Piroplasmosis of Cattle in Hungary.** — FABRICI, JÁNOS in *Allatorvosi Lapok*, Year XXXVII, No. 4, pp. 37-38. Budapest, January 24, 1914.

The writer gives a description of *Piroplasma bovis*, which makes its appearance in some regions of Hungary, especially in the mountainous parts of the county of Mármaros, where it is so virulent as to cause even more havoc than anthrax, with which it is easily confused. In the mountainous districts the disease appears at the beginning of the warm days in spring, generally in the month of May, when the cattle grazing on bushy pastures are attacked by hundreds of ticks, vehicles of the disease.

Piroplasmosis may become chronic, and even contagious. According to M. Hustyra, director of the Royal Veterinary College of Budapest, it is curable. Considering its ravages from an economic point of view, the writer recommends a minute investigation being made.

254 – **Scab and its Cause, with Special Consideration of Chamois Scab.** — FIEBIGER, J. in *Zeitschrift für Infektions-krankheiten, parasitäre Krankheiten und Hygiene der Haustiere*, Vol. III, Part 6, pp. 341-365. Berlin, November 28, 1913.

The writer describes, with the aid of illustrations, chamois scab, the morphology and physiology of the mite that causes it, and discusses the results of his recent experiments on the transmission of chamois scab to three goats and a sheep. The most important results are the following:

1. Goats can be artificially infected with chamois scab and from infected goats the disease can spread spontaneously to other goats. From this it may be inferred that the natural transmission of scab from chamois to goats is possible.

2. Sheep also, though with much greater difficulty than goats, can be artificially infected with chamois scab. A spontaneous transmission of chamois scab to sheep seems, however, unlikely.

3. Transmitted scab in goats has the tendency to heal by itself. The

growth of hair proceeds with extraordinary rapidity. The healing process is ushered in by a falling off of the scabs.

4. The disease begins by the skin becoming horny, which symptom predominates throughout; atrophy, inflammation and hyperplasia set in.

5. The scab mites of many animals do not excavate passages in the epidermis in the direction followed by the sarcoptes mite of man, but they bore vertically or in an inclined direction though all the epithelial layers and finally reach the hypodermis.

255 - **The Udder as an Emunctory: Elimination of Artificial Colouring Matter by the Udder.** — FORCHER, CH. in *Revue générale du Lait*, Vol. 9, No. 18, pp. 409-419. Lierre, November 30, 1913. ANATOMY AND PHYSIOLOGY.

In the first experiment the writer introduced by means of an esophageal tube into the stomach of a goat 0.5 gram of uranin; neither the milk nor the urine of the goat nor the urine of her kid showed later any trace of uranin. Then 1 gram of uranin was injected into a vein of the neck of the same goat, but no proof of the presence of uranin was detected either in the urine of the goat or kid or in the milk or in the digestion product of the casein. The same result was obtained with 3 grams of uranin introduced into the stomach of the goat.

In a second experiment the writer introduced into the stomach of a goat 2 grams of rhodamin. After an hour she yielded a rose-coloured milk; after three hours the rose colour was much weaker and the following day it had disappeared. Submitted to dialysis, the milk allowed the rhodamin to pass through the membrane. On coagulating the milk with acetic acid a rose-coloured casein was obtained, the colour of which disappeared on the further addition of acid. The urine of the two kids was slightly coloured, that of the mother highly coloured. In comparison with the quantity given, the amount that passed into the milk was very small. The rhodamin contained in the milk was completely eliminated in the urine of the kids.

In a third experiment a goat was given 1 gram of methylene blue (Hydrochloride). Her urine and excrements were coloured a deep blue and contained leuco-derivates; but her milk and the urine of the kid showed no traces of blue colouration. Another goat had 3 grams of methylene blue injected into a vein with the result of a slight coloration of the milk and a very slight colour in the urine of the kid. The day after the injection the milk had recovered its normal colour. The quantity of methylene blue that had passed into the milk was at most one three-hundredth part of the quantity administered.

In a fourth experiment 3 grams of crystallized ponceau were introduced into the stomach of a goat. Neither the goat's milk nor the kid's urine showed traces of ponceau.

Lastly in a fifth experiment the writer gave a bitch and three goats dimethylamino-azobenzol. The bitch had 1 gram by way of the stomach, and one hour later the milk, on the addition of hydrochloric acid, was intensely rose-coloured. The puppy also excreted the colouring matter with its urine. Goat No. 1 had 1 gram of dimethylamino-azobenzol introduced

into her stomach, but did not eliminate the colouring matter either in the milk or in the urine. Only the next day, when she was given another gram of the same substance, could its presence in the milk be detected, and a few hours later the milk had recovered its usual colour. Goat No. 2 was also given 1 gram of the colouring matter without its appearing in the milk or the urine. Goat No. 3 was given 5 grams of dimethylamino-azobenzol and only after some hours did her milk become deep blue. On dialysing it, it was found that by far the largest portion of the colouring matter had dissolved in the fat of the milk.

The writer draws from these observations the conclusion that the colouring matters are not eliminated from the udder by only one of the components of milk. In order to leave the udder, some colouring matters dissolve in the whey, others attach themselves to the casein, and others again dissolve, immediately on entering the udder, in the fat globules of the milk. This latter process, according to the writer, is the one to which all colouring matters having a basic reaction are subject, fat being a good solvent for them.

It can therefore be assumed that the intense coloration of butter observed in summer from cows grazing where yellow flowers are abundant is due to the plant components possessing a basic reaction.

It has further resulted from the experiments that the milk glands do not easily allow the passage of colouring matter and seem to exert a severe selection on all molecules brought by the blood, some being accepted and others as strictly as possible rejected. The writer believes, therefore, that the composition of the food and that of the milk are not so closely connected with each other as is commonly believed.

FEEDS FEEDING.

256 – The Effect of Sugar on the Digestion of Nitrogen. — GOUIN, ANDRÉ and ANDOUARD, P. in *Comptes-Rendus Hebdomadaires des Séances de la Société de Biologie*, Vol. 75, No. 36, pp. 550-552. Paris, December 19, 1913.

The writers, in continuation of a previous experiment, carried out a feeding experiment on a growing pig in order to test the effect of sugar on the utilization of nitrogen. The animal was fed daily, during the first period, 500 grams of earthnut cake, 70 grams of degelatinized bone meal and manioc roots *ad lib.* In the successive period the rations were the same, except that Jerusalem artichokes were given *ad lib.* instead of manioc roots. Each period lasted 42 days and during both the writers carried out investigations on the foodstuffs given and utilized. The daily increase of weight was, during the starch (manioc) period, 667 grams, and during the sugar (Jerusalem artichoke) period 595 grams. The manioc starch was always completely utilized, while the sugar of the artichokes was often only incompletely taken up. During the latter period the animal ejected in its excrements considerable quantities of undigested food. At the same time a typical effect of the sugar on the digestion of nitrogen was noticeable, namely that in consequence of a less intense bacterial activity the quantity of nitrogen transformed into gas in the stomach was diminished. While this loss, during the starch period, amounted to 9.38 per cent. of the nitrogen in the food, during the sugar period the loss

was only 0.07 per cent. In previous experiments with a heifer calf the corresponding losses were, in the starch period 20.10 per cent., and in the sugar period 15.86 per cent., while with a steer the losses were respectively 26.77 and 14.08 per cent. It appeared further that when feeding sugar a more abundant excretion of nitrogen in the droppings took place. During the starch period the pig excreted an average of 25.93 per cent. of the nitrogen of the food and during the sugar period 48.73 per cent. In a previous experiment with a heifer calf the corresponding values were respectively 31.86 against 39.43, and with a steer 35.33 against 56.34 per cent.

This experiment thus confirms the observations made previously by the writer on a growing steer, that sugar diminishes the utilization of nitrogen and the loss of nitrogen by fermentation in the alimentary canal.

257 - **The Organic Phosphoric Acid of Cottonseed Meal.** — ANDERSON, R. J. — *New York Agricultural Experiment Station, Technical Bulletin*, No. 25, pp. 1-12. Geneva, N. Y., December 1912.

An acid has been isolated from cottonseed meal which decomposes into phosphoric acid and inosite when heated with sulphuric acid and is in every way very similar to phytic acid. When fed in does of 0.5 and 1 gm. to rabbits, symptoms of distress were observed which passed off in a few hours.

258 - **Cattle-Feeding Experiments.** — BRUCE, W. — *Edinburgh and East of Scotland College of Agriculture, Report* XXXI, 1913. CATTLE.

During the season 1912-13 the experiments of 1911-12 (see Report XXVII) were continued and a comparison was made between the feeding values of linseed cake, of wheat bran, and of a complex mixture consisting of:

Undecorticated cotton cake	2 parts
Decorticated » »	1 »
Linseed cake	1 »
Bran	3 »
Maize meal	1 »

and compounded so as to contain approximately the same amount of food material as would be present in an equal weight of linseed cake.

Three lots of cattle consisting of 16 individuals each were fed with the above materials. The trials were carried on for 19 weeks and the average daily rations during that time were:

Lot I	3.95 lbs. linseed cake, 3.78 und. cotton cake	10.2 lbs. swedes 7.78 » oat straw
Lot II	5 lbs. bran » » » »	
Lot III	7.73 lbs. complex mixture	

The three lots made practically the same increase, the average daily gain being just over 2 lbs. per head, and no differences were observed in the finished cattle of the different lots which could be attributed to the feeding. With linseed cake at £ 8. 16. 3 per ton and wheat bran at £ 5. 8. 9 per ton the concentrated food of Lot 1 cost £ 5. 16. 3 more than that of Lot II, after the value of the manurial residues have been deducted.

259 - **A Study of the Udder Flora of Cows.** — HARDING, H. A. and WILSON, J. K. — *New York Agricultural Experiment Station, Technical Bulletin* No. 27, pp. 1-40. Geneva, N. Y., March 1913.

1230 samples of milk derived from 78 cows were examined bacteriologically. Separate samples were drawn from each quarter of the udder and showed that the germ content can vary considerably in the different quarters of the same udder, the back quarters usually having a far higher germ content than the front ones. Neither the age of the cow nor the period of lactation appeared to exert any marked influence on the germ content of the milk. The number of organisms per cc. varied from 0 to 16 600, with an average of 428. They were classified into 71 groups and were characterised by lack of motility, of spore formation, and of gas formation, consisting largely of micrococci and being practically all Gram positive.

260 - **Carcase Tests conducted on Lincoln and Mangalicza Pigs in Hungary.** — WELLMANN, O. in *Köztelek*, Year 23, No. 97, pp. 3272-3275. Budapest, December 13, 1913.

It is well known that the most esteemed breed of pigs in Hungary is the curly-coated Mangalicza pig (1), which owes its popularity to its high yield in fat and its suitableness to the conditions of the country. With the growing intensity of agriculture in Hungary, it becomes very desirable to improve this breed from the point of view of prolificacy and early maturity.

The English Lincoln Curly-coated breed resembles the Mangalicza in many points, but is more prolific and earlier maturing; consequently it seems the most suitable for the improvement of the latter breed.

With this object in view, crosses between Lincolns and Mangalicza have been practised since 1910. In order to ascertain how far the Lincoln pigs answer to the requirements of the Hungarian breed, the National Agricultural Association of Hungary (Orzságos Magyar Gazdasági Egyesület) entrusted a committee with the carrying out of carcase tests in the municipal slaughterhouse of Budapest on fattened Lincoln and Mangalicza pigs and on crosses between the two breeds. The description of the pigs experimented upon and the carcase results are shown in Table I.

These data show that among pigs fattened for five months on barley and maize groats the dead-weight of Lincoln × Mangalicza pigs at 14 months was the same as that of the pure-bred Mangaliczas at 26 months. The dead-weight of all the animals amounted to 82 to 88 per cent. of the live-weight.

(1) See No. 559, *B*. May 1913. (*Ed.*).

TABLE I.

Pigs slaughtered	Age	Live weight		Blood		Bristles		Offal		Internal fat		Dead weight	
	Months	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%
Lincoln × Mangalieză	28	730	100	14	1.9	10	1.4	72	9.8	28	3.9	629	86.1
Mangaliczà	50	535	100	10	1.8	10	1.9	44	8.2	18	3.5	471	88.4
Lincoln	42	847	100	—	—	—	—	—	—	—	—	713	84.2
Mangaliczà	26	420	100	—	—	—	—	—	—	—	—	365	87.0
»	»	469	100	—	—	—	—	—	—	—	—	385	82.2
Lincoln × Mangaliczà	14	453	100	—	—	—	—	—	—	—	—	385	85.0
» »	»	495	100	—	—	—	—	—	—	—	—	431	87.1

261 - **Bacteriology of the Hen's Egg with Special Reference to its Freedom from Microbic Invasion.** — RETTGER, LEO F. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 39, No. 23-25, pp. 611-624. Jena, January 6, 1914. POULTRY

In the course of the extended investigations of bacillary white diarrhœa of chicks, which has been carried on at the Storrs Agricultural Experiment Station for the past three years, bacteriological examinations have been made of more than ten thousand eggs. Many of the eggs were fresh when examined, while others had been incubated from one to three weeks. Most of the eggs came from the College and Station stock; others were received from different parts of the country.

For the investigations only clean and normal-looking eggs were used. In testing the eggs agar cultures were made from the yolk and the white, both the direct and the indirect methods being followed. The writer also conducted a series of fermentation experiments in order to determine the presence of organisms of the Bacillus coli type.

Table I shows the number of eggs examined and the numbers of bacteria found in them.

Bacterium pullorum, the specific organism of white diarrhœa, is no indication of the bacterioloicgal content of the eggs, as all the eggs infected with it come from ovaries in a pathological condition. Excluding this bacterium it is interesting to note that eggs which have been incubated from one to three weeks contain very few bacteria. But the yolks of fresh eggs also show a low bacterial content. Among the incubated eggs, those that had been incubated one week contained considerably more bacteria than those which had been incubated two weeks. The reason of this is not clear, as the temperature of incubation was the same in the two cases. It is, of course, true that the first-test eggs are to a large extent infertile; they also include some which, although they have been fertilized, have failed

State of eggs when tested.		Number of eggs tested	Number of infected eggs	Number containing *B. pullorum*	Per cent. infected eggs, not including *B. pullorum*
Fresh eggs	Entire yolks	3 510	500	169	9.5
Incubated one week	Entire yolks	1 746	68	20	2.75
Incubated two weeks . . .	Entire yolks	2 167	56	28	1.3
Incubated three weeks . . .	Entire yolks	1 984	179	108	3.6
Fresh eggs: whites, 5 cc. quantities . . .		582	7	0	1.2
» » yolks, 10 cc. quantities . . .		647	36	11	3.86

to undergo embryonic development. According to these facts, fertile eggs appear less liable to bacterial invasion than infertile ones, which is contrary to general opinion. It is probable that some of the fertile eggs which failed to develop contained bacteria which prevented or arrested early development.

That the relative number of eggs which harbour bacteria other than *B. pullorum* is greater for those which have been incubated three weeks than for the seven and fourteen day eggs is to be expected.

The percentage of positive results obtained with the whites is undoubtedly higher than the actual facts warrant. It must be said, however, that these investigations were made in the height of summer, that is at a time when considerable difficulty was experienced in obtaining aseptic conditions. It is therefore probably safe to say that the whites of fresh normal eggs are as a rule sterile.

In the fermentation tests, which were made to determine the presence in the whites of the gas-forming bacteria, 105 eggs were examined and the results were all negative.

The microorganisms found in the yolks of fresh and incubated eggs from healthy ovaries, arranged according to the number of times found, are grouped in the following summary:

FRESH EGGS.

Staphylococcus usually *aureus* and *albus*.
Subtilis group » *B. mesentericus* and *B. ramosus*.
B. coli and closely related organisms,
Proteus group.
Streptococcus.
Micrococcus (*tetragenus*, etc.).
Streptothrix.
Diphtheroid bacillus.
Putrefactive anaerobes.
B. fluorescens.
Mould.
B. mucosus.

INCUBATED EGGS.

Staphylococcus usually *aureus* and *albus*.
B. coli and closely related organisms.
Subtilis group, usually *B. mesentericus*.
Proteus group.
B. pyocyaneus.
Streptococcus.
Streptothrix.
Mould.
B. fluorescens.
Diphtheroid.
B. mucosus.

The writer compares these results with the data given by other investigators, especially Lamson, Poppe, Stiles, Bates, Zörkendörfer and Kossowicz, and then gives the following summary and conclusions:

1. The contents of normal fresh eggs are, as a rule, sterile. It is quite probable that an egg yolk may become invaded before it is expelled from the ovary; but this is apparently an uncommon occurrence except when the ovary is infected with the organism of bacillary white diarrhœa.

2. Little if any infection takes place in the oviduct while the white and the shell are being deposited, on account of the protective action of the mucous lining and also the bactericidal action of the egg white itself.

3. Even eggs that have been incubated artificially for three weeks remain relatively free from bacterial decomposition, providing they were fresh and clean when placed in the incubator.

4. Under normal conditions the shell is bacterium-proof. Moisture lessens its impervious character, however, and when combined with dirt, makes it possible for micro-organisms to enter. Increased temperature then hastens the decomposition.

5. Eggs should be gathered from the nests soon after they are laid; the nests must be kept in a sanitary condition to prevent soiling of the eggs.

6. When they are to be preserved for any length of time only clean eggs should be selected; unless they are placed in preserving fluids, eggs must be kept dry.

7. There is no evidence to indicate that fertilized eggs spoil more readily than the unfertilized, as they do not contain more bacteria than the latter.

FARM ENGINEERING.

262 - **Ransome's Steam Traction Engines.** — MANRIN, in *Bulletin de la Société pour l'Industrie Nationale,* Year 112, Vol. 120, No. 3, pp. 483-485. Paris, November 1913. AGRICULTURAL MACHINERY AND IMPLEMENTS

The writer describes these traction engines, which have two speeds, 1½ and 3 miles per hour. They are built in five sizes.

The first four traction engines have one cylinder, the last is a compound. Their normal performance is respectively 5, 6, 7, 8 and 10 H P. Besides their usual work as traction engines for agricultural tillage implements, they may be used as common portable engines.

263 - **The Electromotor and the Small Farm.** — STRAUSS, W. in *Dinglers polytechnisches Journal,* Year 95, Vol. 329, Parts 1 and 2, pp. 4-7 and 20-23. Berlin, January 3 and 10, 1914.

While about fifteen years ago it was currently believed that electric energy was especially suitable for large farms, now, on all sides, it is seen that it is especially the medium and the small farmer who can use electric power very advantageously. In this paper the writer points out the great benefits that small farms derive from the use of electric power, and comes to the conclusion that it renders possible an increase of the gross returns,

a diminution, though small, of working expenses, and, what is of great importance to the farmer, the substitution of mechanical power in the place of labourers and teams. A further beneficial effect of the use of electricity is a further development of the spirit of cooperation.

264 - **Agricultural Motors for the West Indies.** — *The Implement and Machinery Review*, Vol. 39, No. 466, p. 1363. London, February 1, 1914.

According to a report of the Canadian Trade Commissioner in Barbados, the Imperial Department of Agriculture and the local agricultural associations in the British West Indies afford assistance to firms importing machinery and implements. In Ste. Croix in consequence of experiments previously made by the Danish authorities, agricultural motors have been imported and work successfully. The Canadian Trade Commissioner further reports that in St. Kitts, St. Lucia, Montserrat and Antigua the soil is deep and loamy and consequently suitable to mechanical tilling. In Barbados, on the contrary, with the exception of small areas, the soil is not suitable.

265 - **The Work of the Windlasses, of the Cables and of the Pulleys in Mechanical Ploughing Outfits.** — RINGELMANN, M. in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 112, Vol. 120, No. 3, pp. 465-482. Paris, November 1913.

In the few experiments hitherto made with steam ploughing windlass and cable outfits, the observations were limited to a determination of the work of the cylinder by means of an indicator and to a comparison of this with the work done by the ploughing implement. With internal combustion motors the consumption of fuel was compared with the performance of the ploughing implement. Such determinations, however, from the technical point of view are insuficient, and M. Ringelmann in connection with the trials at Plessis, in which Howard's system of cable tackle round the field was used, calculates in this paper on the one hand the amount of energy required by the windlass, under the various conditions of position and length of the cable as well as the position and number of the guide and corner pulleys, and on the other hand the energy transmitted to the tilling implement situated at the other end of the cable.

The writer gives a summary at the end of his paper, with data on the percentage distribution of the total energy transmitted from the motor to the windlass.

Energy required	for the windlass	3.4	24.9
	» » corner pulleys	15.5	
	» » cable	4.2	
	» » various losses	1.8	
Energy given up at the extremity of the cable . . . 75.1	Energy required by plough		61.0
	Energy for paying out the cable		14.1
Total energy supplied by the motor			100.0

The following is the distribution of the energy required by the cable:

Energy required	for the cable	4.2	30.1
	for the corner pulleys	2.8	19.6
	for the windlass drum	7.1	50.3
Energy transmitted by the plough		14.1	100.0

These data facilitate in a simple manner the determination of the consumption of energy for any system of mechanical tillage.

266 - **Trial of Motor Ploughs.** — *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 28, Part 42, p. 580. Berlin, October 18, 1913. — *Deutsche Landwirtschaftliche Presse*, Year 41, No. 2, pp. 16-17. Berlin, January 7, 1914.

From the official report of the trial of motor ploughs which took place at Klein Wanzleben from August 21 to 23, 1913, the following verdicts are taken :

1. *Motor plough of Friederich Kuers (Tegel).* — The two-engine system of steam ploughing has the advantage of great steadiness of work, but the disadvantage that the tackle is cumbersome to move about and that heavy outlay is required on the plant in comparison to the work done. This system further lends itself only to a limited extend to other work besides ploughing. The traction engines are solidy built and reliable and in consequence of the low number of revolutions are probable durable. During the main trial the performance was limited in quantity ; during the trial of resistance it was higher ; the quality of the work was good.

2. *I. H. C.* 30 *to* 60 *H. P. motor with eight-furrow plough of the German International Harvester Company Ltd., (Berlin).* — The tractor system is easier to move about and is suitable for mowing and many other agricultural operations besides ploughing. On slippery or very loose soil there is the danger of coming to a standstill through the wheels skidding. The number of revolutions of the motor is moderate and its probable durability is good. Its performance was very good, both as regards quantity as well as quality.

3. *Caterpillar motor tractor with tilling and transport implements belonging to it, presented by the general agent of the Holt Caterpillar Company (Budapest).* The Caterpillar system presents the advantage of great traction power and consequently it is relatively very reliable ; on the other hand its installation is expensive and it is somewhat cumbersome to move about. The traction engine is complicated and, it is anticipated, will be very liable to wear out. Its performance was very good, as to both quality and quantity.

4. *Universal* 45 *to* 50 *H. P. motor plough, of the Universal Motorpflug-Gesellschaft m. b. H. (Munich)*— The machine presented the advantages and disadvantages of the tractor system. Its construction led to numerous interruptions of work. Its performance was very good as to quality, but low as to quantity and the consumption of fuel was high.

5. *Pöhls' Patent motor plough, of Gustav Pöhl Maschinen and Motorpflugfabrik, g. m. b. H. (Gössnitz, Sachsen-Altenburg.)* — Pöhl endeavoured

to apply the tractor system to small farms. The machines did not show satisfactory reliability.

6. *Stock motor plough, of the Stock Motorpflug-Gesellschaft m.b. H. (Berlin).* — Stock represents the first machine built on the motor-car plough system, which offers the advantage of combining low total weight and correspondingly low cost of installation. Its reliability on soft soils is greater than with the tractors, with the exception of the Caterpillar. The construction is good, but the number of revolutions of the motor is high and its probable duration is limited. Its performance was sufficient as regards quality and good as to quantity.

7. *Power plough on Wendeler Dohrns' system of the Deutschen Kraftpflug-Gesellschaft m. b. H. (Berlin).* The motor plough is a handy and solid development of the motor-car plough. Its performance was good in quality and quantity.

8. *"Acra" motor plough of the "Kyffhäuserhütte" Aktien-Maschinen fabrik.* — This machine is intended as a development of the motor-car plough system for the heaviest work. It will, however, attain this object only after certain improvements in its construction.

267 – **Trial of a Double-Furrow Turn-Wrest Plough with Lever Adjustment.** — PUCHNER, H. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 5, pp. 182-185. Berlin, 1913.

In the introduction to his paper, the writer gives an illustration of this plough and describes it. It differs from similar machines in that the depth and breadth of the furrow can be regulated whilst the plough is working.

One of these ploughs was tried on the Royal estate of Weihenstephan and proved useful and easy to handle. The lever adjustment used while working was recognized as a distinct advantage.

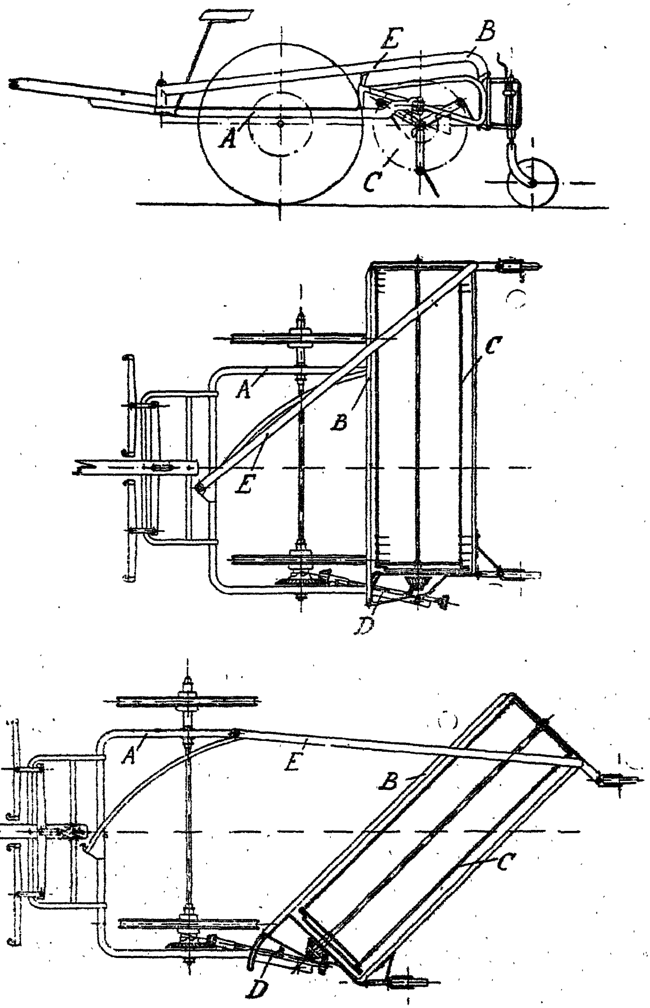
Determinations of the traction power it requires showed that 308 to 396 lbs. are sufficient in loamy soils. The plough can consequently be drawn by two average horses without excessive fatigue. It can be adjusted to depths varying from 1 ½ to 7 inches, and to a maximum breadth of 19 inches. It weighs about 370 lbs. and is most suitable for medium soils. The price of the plough with coulter and reserve share is £6 11s 4d.

268 – **Trial of a Combined Hay Tedder and Side-delivery Rake.** (42nd Report of the Machine-testing Bureau of the Chamber of Agriculture for the Province of Brandenburg.). — FISCHER, G. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 6, pp. 229-234. Berlin, 1913.

This machine was used during the whole hay season of 1913 on the Gutenpaaren estate. It consists of a frame, *A*, on wheels, connected with another frame, *B*, carrying a revolving rake or tedder, *C*. The position of the tedder can be shifted by moving the frame that carries it round a vertical pivot. When at right angles to the direction in which the machine is drawn it acts as a tedder, when shifted round to an angle of 45° with its former position it acts as a side-delivery rake. The figures show the machine in both positions. The rake is driven by conical gearing on the axle of the front

wheels, and on an intermediate shaft, *D*. The change in the position of the rake is effected by removing a pin in the head of the connecting draught rod, *E*, and turning this round to its new position.

The writer describes the experiments that were made with the machine and gives its most important dimensions and the speeds at which the several parts work. In conclusion, he states that the combined tedder and side-delivery rake worked very well on extensive areas through the whole season without any interruption. It worked satisfactorily also when turning round.



Combined hay tedder and side-delivery rake.

269 - **Theory of the Drum for Threshing Machines.** (Trial of agricultural machines at the Moscow Agricultural Institute). — GORJATCHKIN, W. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 5, pp. 185-225. Berlin, 1913.

This paper, which throws light from a purely mechanical point of view on some of the more difficult problems connected with agricultural machines, is intended for specialists in the construction of threshing machines.

The writer deducts the fundamental formula for the work of the drum of the threshing machine, examines it and gives several diagrams of velocities. In order to prove the connection between the motor and the work of the drum, besides these experiments made in 1910 and 1911 a whole series of complementary experiments should be carried out, namely:

1. On the friction of the axles at various numbers of revolutions.
2. On the resistance of the air at various numbers of revolutions.
3. On the slipping of the belts when running empty or with load.
4. On the performance of the motor at various numbers of revolutions.
5. On the effective acceleration of the drum at various numbers of revolutions, and the power of the motor, that is the curve of the increase of velocity when running empty.

270 - **Average Results of Threshing Experiments.** — HAGENSTEIN in *Maschinen-Zeitung*, Year 12, No. 1, pp. 8-9. January 1, 1914.

The writer gives the results which he obtained by some experiments on threshing cereals, in which feeding the sheaves headfirst (Langdrusch) was compared with feeding them sideways (Kopfdrusch). The sheaves were made by a Deering six-foot binder, and thrashed by a good Flöther threshing machine provided with baler and automatic binder.

Barley. - Headfirst feeding. — In one hour 156 sheaves weighing 31 lbs. each were threshed; the loss of grain was 192 grams per sheaf, or 660 lbs. in 10 hours. Performance per hour, 3527 lbs., weight of straw about 4925 lbs.

Sideways feeding. — In one hour 210 sheaves weighing 31 lbs. each were threshed. The loss was 80 grams per sheaf, or 370 lbs. in 10 hours. The quantity of barley threshed per hour was 4960 lbs., the weight of the straw 6482 lbs.

With this output from headfirst feeding the loss would be 928 lbs., an excess of 558 lbs. over the sideways feeding.

Mixture of one-third barley and two-thirds oats. - Sideways feeding. — In one hour 225 sheaves weighing 27.6 lbs. each were threshed. The loss per sheaf was 33 grams of grain, or in 10 hours 163 lbs. The total threshed was 5126 lbs., the weight of straw being about 6200 lbs.

Headfirst feeding. — In one hour 186 sheaves weighing 27.6 lbs. each were threshed; they yielded 3803 lbs of mixed grain. The loss per sheaf was 56 grams of grain, or in 10 hours 229 lbs. Weight of straw about 4921 lbs.

Thus the extra loss on headfirst feeding on the quantity threshed in ten hours by sideways feeding was 146 lbs.

271 — **Milk Separator "Göricke R. N. E. 1."** (8th Report of the Agricultural Machine and Implement Testing Station at Tábor, Bohemia). — CERNY, I. in *Mitteilungen des Verbandes landwirtschaftl.-Maschinen-Prüfungs-Anstalten*, Year 7, Part 5, pp. 177-182. Berlin, 1913.

This milk separator is intended to be worked by hand and for the treatment of about 33 gallons per hour. Its total weight is about 70 lbs. The writer gives a minute description of the machine and of its working, and then reports upon the results obtained at the trials. These were carried out between July 31 and August 24. The chemical investigations were conducted in the laboratory of Prof. R. Truka at the Royal Bohemian Agricultural Academy at Tábor.

The paper contains tables of the data collected during the trials, some of which were made with the milk at 35° C. (95° F.), others at 30° C. (86° F.) and at 25° C. (77° F.) The number of revolutions per minute varied from 70, normal, to 60.

The verdict of the judges was that the separator removes the cream well, its running is smooth and easy and its presumable durability is high.

272. - **Centrifugal Milk Filter "Albissa".** — *Deutsche Schlacht- und Viehhof-Zeitung*, Year 13, No. 52, pp. 799-800. Berlin, December 28, 1913.

This centrifugal filter is a machine for cleaning milk; it unites the advantages of centrifugation with those of a cotton filter. It is very cheap, requires but little time and power and is also highly recommendable from the hygienic point of view.

The machine consists of a support and the drum proper. The latter has a first strainer in which the coarser impurities are separated out. The drum itself consists of an inner perforated head, round which cotton wool is placed and then stretched and firmly kept in its position by an equally perforated frame. This machine, worked by hand, can easily pass 220 gallons of milk per hour through a single cotton filter; driven by power it can treat as much as 1100 gallons in the same time, purifying the milk mechanically in the most complete manner.

273 – **Revolving Churn with Frame.** — *Deutsche Landwirtschaftliche Presse*, Year 41, No. 4, p. 45. Berlin, January 14, 1914.

The novelty in this churn consists in the pivots round which it revolves being no longer attached to the vessel itself but to a frame in which the churn is placed. The advantages of the machine are the facility with which the vessel can be removed and handled and the easier and smoother running.

The churn is made in different sizes to hold from 15 to 44 gallons, and its price ranges from £ 4 8*s* to £ 6 12*s* 4*d*.

274. - **Potato Drying as Auxiliary Industry for Distilleries.** — DEGEL, R. in *Deutsche Landwirtschaftliche Presse*, Year 40, No. 93, p. 1104. Berlin, November 19, 1913.

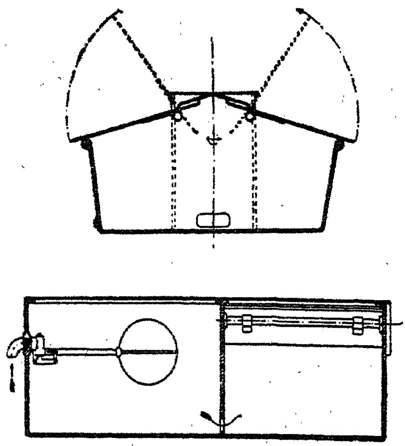
The writer gives an estimate of the working expenses of potato-drying works of various output, attached to distilleries. The great difference in the cost of drying in such works as compared with that of independent drying factories, is chiefly due to the fact that in the former part of the distillery plant can be used, the manager of the distillery can look after the drying, and only one or two extra men are required.

BUILDING STRUCTION.

275 - **Automatic Drinking Trough.** — *Deutsche Landwirtschaftliche Presse*, Year 41, No. 2, p. 17. Berlin, January 7, 1914.

This drinking trough, of which a front view and section are given, has been declared by the German Agricultural Association (Deutsche Landwirtschafts-Gesellschaft) as " new and worthy of consideration ".

It is intended especially for pigs and young stock. It consists of a central reservoir with float and two drinking troughs, one on each side of the reservoir. In order to allow the troughs to be easily opened and noiselessly closed, the covers are provided with counter weights. The main water-pipe communicates with the reservoir by means of a small bore pipe; the water passes from the reservoir into the trough by an aperture in the side between the two. When the animals drink out of the trough and the level of the water sinks in it, the float opens a tap which allows fresh water from the main pipe to flow into the reservoir until the proper level is again reached. The advantages the apparatus presents are that it automatically supplies the animals with the required quantity of fresh pure water, that it is easily and cheaply put up, that all its parts are accessible, and that it is effectually protected against dirt of any kind. Its price is about £ 1.15 *s.*



Automatic Drinking Trough.

RURAL ECONOMICS.

276 - **The Significance of the Fluctuations in the Price of Cereals for the Profitableness of the Moravian Peasant Farms.** — OSTERMAYER, ADOLF in *Oesterreichische Agrar-Zeitung*, Year IV, No. 50, pp. 559-602; No. 51, pp. 611-614; No. 52, pp. 625-627. Vienna, December 13, 20 and 27, 1913.

The writer states that the prices of cereals between 1906 and 1907 underwent a permanent rise, due for the most part to the increase of the customs duty. He examines the effect of the fluctuations in the prices of cereals

TABLE I.

Year	Average price of cereals per cwt.	Average cereal duty	Net returns per acre	Net returns in percentage of capital in farm.
	s d	s d	s d	
1902	6 11	1 1 1/2	21 8 1/4	3 per cent and less.
1903	7 2 3/4		20 7 1/4	
1904	7 0 3/4		22 4 1/4	
1905	7 2		22 0	
1906	6 11 1/2		21 10 3/4	
1907	8 1 1/2	2 7	23 10	3.25 to 3.5 per cent.
1908	8 10 1/2		25 1 1/2	
1909	9 6 1/4		25 10	
1910	8 4 1/4		23 10 1/2	
1911	9 1 1/4		25 6 1/4	

TABLE II.

Period		Average extent of farm	Value per acre	Net returns		Compens. for work		Total income		Increase of rate of interest	Interest on debts		From net returns interest of debts claims per cent.	Thus less than formerly
				per acre	in per cent. of capital	per acre	in per cent. of capital	per acre	in per cent. of capital		per acre	in per cent. of capital		
		acres	£ s d	s d		s d		s d			s d			
Before	1907	25.06	44 1 1	12 8	1.43	47 5	5.38	60 1	6.81	—	8 8	0.94	65.7	—
After				15 6	1.75	47 5	5.38	62 11	7.13	+ 0.32			53.7	12.0
Before	1907	47.35	35 18 2	18 6	2.57	25 4	3.52	43 9	6.09	—	6 0	0.83	32.2	—
After				21 10	3.04	25 4	3.52	47 2	6.56	+ 0.47			24.0	8.2
Before	1907	130.84	28 18 6	16 5	2.84	15 6	2.68	32 0	5.52	—	3 7	0.61	21.4	—
After				20 3	3.50	15 6	2.68	35 10	6.18	+ 0.66			17.4	4.0

between the years 1902 and 1911 on the average net returns of 60 Moravian peasant farms. Assuming these farms to send to market an average of only 44.1 per cent. of the cereals they produce, the receipts from the sale of cereals would average only 16.9 per cent. of the total receipts of the farm, yet the increase in the price which took place after 1906 increases considerably the profitableness of the farms, for the rate of interest of the capital invested in them, which up to the year 1906 had been only about 3 per cent., rises above this figure, up to 3.5 per cent.

If the 60 farms be divided according to their altitude into three groups, and then the effect of the increase of the price of cereals upon the profitableness of these groups of farms be examined, it will be found that the rate of interest in the years 1902-06 averaged for the farms situated in the plain about 3 per cent., for the farms situated in the mountains about 1.12 per cent., and for those in an intermediate position about 2.25 per cent.; while for the years 1907-11 the corresponding rates of interest were 3.5, 1.75 and 3 per cent.

In order to ascertain whether the increase of prices was important for the small farms, as well as for the large and medium ones, the writer divides the 60 farms into three groups according to their extent and calculates for each their net returns, the rate of interest on the capital invested in them, the compensation to the members of the owner's family for their intellectual and manual labour, as well as their resulting income for the two five-year periods — one before the effect of the increased duty and one after, that is before and after 1907. He examines further the effect of the increase of the net returns upon the indebtedness of the farms. The results are collected in Table II.

The smaller the farm the greater is the part taken by the compensation of labour out of the total income and the smaller the rate of interest on the capital. The increased rate of interest due to the increased duty and consequently higher prices of cereals grows with the extent of the farm; nevertheless the slight increase observed in the smallest farms acquires greater importance for the conservation of the property, when it is considered that in consequence of the improvement that set in in 1907 of the ratio between returns and interest on debts, the latter claims 12 per cent. of the returns less than formerly, while in the other two groups of farms this benefit is 8.2 and 4 per cent. respectively. In the paper all these results are grouped in tables and diagrams.

277 – **The Amortization of the Capital in Buildings in Swiss Agriculture.** — TANNER, CARL in *Archiv für exakte Wirtschaftsforschung*, Vol. 5, Parts 3 and 4, pp. 530-583. Jena, 1913.

The writer first defines the problem and then states the opinions on the subject current in agricultural literature. He is opposed to the theory of the fund for a new building and that of the paying off of the cost, and in favour of the simple depreciation theory (according to Laur). Consequently he does not approve of compound interest being used in the calculation of the quota of amortization. This must not, however, depend upon the caprice and requirements of the accountant, but must be based on firm prin-

ciples founded on the real depreciation of the building due to wear and tear and to the effect of economic factors (technical progress, change in the trend of the farm).

With this object in view, it is advisable to decompose the value of the buildings into separate groups, the wear and tear of which follows the same or similar laws. The amortizable parts of the building (in opposition to those that are not to be amortized, namely the site and the value of the materials after demolition) are best divided into two groups, one comprising those parts which last the whole time over which amortization extends, and the other those that have to be renewed once or oftener during the time that the building will last. This latter group can be still further subdivided. The quota of amortization of each group is obtained by dividing its original value by the duration of the corresponding group. The amortization quota of the whole building is then the sum of the quotas of each group. The more extensive repairs (renovation or upkeep repairs) are to be booked as a supplementary value of the corresponding group and amortized like the other parts of the building.

The gradual depreciation of a building caused by technical progress or by the change in the trend of the farm can best be united to the amortizement due to wear and tear by shortening the probable duration of the group of parts that lasts the whole time of the building. This group is the only one really affected by the above depreciation, and shortening the duration correspondingly increases the amortization quota.

The amortization is given in percentages of the original value.

The writer deals then more specially with conditions obtaining in Switzerland in respect of agricultural buildings. By means of question sheets

	Calculated on the basis of extensive subdivision of the capital in buildings into groups	Calculated on the basis of subdivision of the capital in buildings into permanent and renewable parts
	percentage	percentage
Dwellinghouse of the Fricktaler type (North-west Switzerland)	1.25	1.31
» » the Berne type	1.47	1.50
» » the Freiamt type	1.40	1.38
» » the Lucerne type	1.33	1.46
Outbuildings und stable of the Fricktaler house	2.22	2.23
» » » of the Berne house	2.59	2.59
» » » of the Freiamt »	2.19	2.62
» » » of the Lucerne »	2.39	2.56
New outbuildings of the transition type of 1880	2.52	2.43
New outbuildings, built after 1905	2.47	2.50
Cheese dairy: Dwelling house	1.55	—
Work rooms and cellarage	2.14	—

addressed to farmers, country builders, carpenters and architects, he ascertained the duration of agricultural buildings and their parts and used these data to calculate the amortization percentages. Further, with the aid of the valuations of buildings made by the fire insurance institute of canton Aargau, and considering the various types of Swiss buildings, he calculated first the percentage of the various groups in the total capital invested in buildings and then their quota of amortization expressed in percentage of the original value. The addition of the amortization quotas of the separate groups gives for the whole buildings the amortization percentages of the original value, including the amortization of periodically recurring repairs (see Table. p. 395).

The contents of the question sheet, the answers obtained, as well as the separate and average results of the calculations, are shown in tables.

278 - **Proposals for Reform of the Valuation System based on the Inherent Capacity of the Soil (« Bonitierungstaxe »).** — AEREBOE, F. and BRINKMANN, F. — *Teil II der Vorschläge zur Reform der Taxprinzipien des Kur- und Neumärkischen Ritterschaftlichen und des Neuen Brandenburgischen Kreditinstitutes*, pp. 1-53. Berlin, 1914.

In the first, or theoretical, part of their work, the writers begin by treating the following fundamental question: whether it be well to keep to the present method of valuing land, which consists of a "scheme of valuation based on returns" ("schematisierte Ertragstaxe"), or whether it would not be advisable to substitute for it a capital valuation which does not attempt to determine the total and mortgage values of an estate by the round-about method of calculating the gross returns and working expenses and from them the capitalised net returns, but values directly the kind and amount of capital involved in the estate.

To discuss the question, the actual meaning of "the capitalised value of an agricultural estate" ("Ertragswert eines Landguts") must be clearly defined. It is usually defined as the capitalised value of the mean returns over a number of years. But even leaving aside the fact that, owing to the large annual fluctuations of the net returns, the number of years taken will exert a considerable influence on the mean value of the net returns and therefore on the final result, *i. e.* on the amount of the capital determined, the capitalised value of agricultural estates, like the value of any other source of return in national economy, can only be expressed in terms of future returns, while past returns can only serve to predict *probable* future returns. The capitalised value is therefore only the expression of a future capacity for returns, that is a purely estimated value, obtained not by a single estimate but by a general estimate in the scheme of national economy, and may also be obtained by capitalising all the common values of all future returns from agricultural estates. Therefore the capitalised value and the common value of agricultural estates should be equal.

It follows that equal net returns would not always yield equal capitalised values. In practice there are always a number of factors which cause the money value of equal returns to correspond to a variety of capitalised values which may differ considerably amongst themselves. Such factors are, for example, the different conditions of

credit and taxation in the various countries, for the important point is not the sum total of the net returns, but simply that part of the net returns which the agriculturist receives as rent for his land under identical conditions. Another still more important factor in this connection is the manner in which the purchasing power of a given income from an estate will vary according to the position of the estate, for an estate is not only a means of earning a definite sum of money, but also the place of residence of the agriculturist.

It may be concluded that the net returns as defined by Thaer and Von der Goltz cannot be utilized directly for the valuation of estates, that there is not at present and never has been a capitalised valued obtained from net returns capitalised at a fixed rate.

But all the above factors are automatically taken into consideration in settling the market price of an estate. The writers show how these prices will vary with the returns, future possibilities being considered not only by the purchaser but also by the seller, as the prices only constitute a statement of the minimum returns to be obtained for a certainty by the purchaser. The market price is therefore the only reliable means of estimating the value of an estate, and should always serve as the basis of valuation, whether the question be one of credit, succession, expropriation or taxation. For values are merely a statement of prices, and any valuation established without regard for prices may be set down at once as deprived of a valid base. Therefore all so-called valuations based on returns are of no scientific or practical value.

Over and above the impracticability of the process of valuation recommended by text books on the subject and known as the " detailed valuation based on returns " (" ausführliches Ertragstaxverfahren "), such a valuation could never give reliable results, even if unlimited time could be spent on the work and unlimited knowledge were brought to bear on the subject, because of the inaccuracy of the gross returns estimates, and because of the impossibility of determining exactly the rate at which the net returns are capitalised. The fact that many credit societies have worked successfully for some long time using the scheme of valuation based on returns may be readily explained, as these valuations are not really " valuations based on the returns " (" Ertragstaxen ") but capital valuations (" Kapitaltaxen ") determined on the basis of returns calculated from the interest of the market price, and for which, therefore, the point of departure is a capital value and the end point is the same capital value attained via nominal gross returns, working expenses and net returns, which are then capitalised.

But in such a system of valuation based on returns there is no clear indication as to which part of the total value of the estate constitutes its mortgage value, while on the other hand the capital valuation enables the limit of security (" Kreditwürdigkeit ") of each farm to be determined very exactly, for the principal task of the capital valuation is to determine easily and accurately the value of the land as apart from the total farming capital. Then it is only necessary to add to this value the mortgage value

of the buildings, in order to obtain the total mortgage value and the total limit of security of the estate. Besides, the capital valuation is more easily and better adapted to changes of circumstances than is the valuation based on returns.

Payment of rent in cash is a quite unsuitable basis for a system of valuation of scientific value, for, owing to the variation of the mutual obligations between landlord and tenant, its value is too changeable to form an accurate basis for the estimation of the farmer's capital and much less for the estimation of the total value of the estate.

In the second part of their proposals, the writers outline a scheme of valuation ("Taxrahmen") for the systematic capital valuation, and discuss the manner in which different farms are to be entered according to this scheme.

From the above discussion it will be obvious that it is necessary in the first place to have an accurate knowledge of present prices and of their recent development, if a scheme of valuation is to be established which includes the value of all classes of cultivated soil within the working area of each credit institute, classed according to the crops carried and to the quality of the land. The writers make use of the data on prices, which the Prussian Ministry of Finance began to collect in 1889, to establish a mean value for the farms in the different parts of a single credit institute area, classified according to their size and according to the net returns, which served as a basis of assessment for the land tax.

These data only indicate that portion of the price of estates to be attributed to the bare soil, taking no account of the different crops on these estates, and must therefore be further detailed in order to define that part of the price due to each particular crop; for, as the proportion of the different crops varies largely from one estate to another, and the standards of quality of the different crops also vary, the exact value of agricultural estates cannot be established by means of the systematic capital valuation unless a scale of valuation is established in the first place for the various kinds of crops: *viz.* arable fields, meadows and pastures, and also for forests and freshwater fisheries when required, and, in the second place, for different qualities of land under these different crops.

Such special values may be established on the following basis: 1) that estates with high quality soil usually have little meadowland, and therefore that the soil on such estates furnishes a pure value for arable soil; 2) that it is just on the best soils that both arable fields and meadows are equally well adapted to give the best results, and that therefore the value of the best arable fields also represents a maximum value for meadows, and the same scale of values may consequently be used for both. Pastures may also be treated like arable fields if their soil is of such a quality that they could equally well be turned into arable land, and therefore the values of pastures and arable fields only differ by the cost of turning a pasture into arable land. This cost is negligible in comparison to the value of high quality land; consequently, the value of the best pastures is approximately equal to that of

the best arable land, while poor pastures are worth considerably less than poor arable soil.

In order to allow for the great differences in the economic conditions which exist in the different regions of a large credit institute area, the whole area is divided into regions in which different economic conditions prevail, and supplements are added where optimum conditions exist in the subdivisions. These supplements are calculated from the difference of value between the best and worst economic conditions and may amount to 70 per cent. of this difference at a maximum, while they should never be under 5 per cent. of the smaller value itself, increasing inversely with the quality of the land and directly with the size of the farm.

It is also necessary to add supplements where specially good conditions prevail in the case of meadows, but these are much smaller when valuation is based on the quality of the land ("Bonitierungstaxe") than when it is based on the net returns which serve as a basis of assessment for the land tax ("Grundsteuerreinertragstaxe").

As to the standard by which the land is allotted to the different classes in the scheme, the writers not only allow for the composition of arable soils as judged by their principal constituents, but also for their suitability to the principal crops. Arable soils are divided into eight classes, each having a different money value. Meadows are also divided into eight classes chiefly according to their water supply and to the quantity and quality of their hay. Forest soils are divided into five classes, chiefly according to their suitability to certain forest species and to the character of their underwood, the latter character being also a good indication of the condition of their water supply. In establishing this scale of values for forest soils, the writers have not, however, made use of the market price of the estates, but of the price which these would fetch if sold to the forest administration. The freshwater fisheries are divided in the first place into natural waters, which cannot be run dry, and artificial lakes which can; the latter are again subdivided into four classes according to the ease with which the water supply can be controlled and to the nature of the land, while the natural waters are subdivided into three classes according to the quality of their fishing.

As to the allocation of the estates in the different economic zones, it is convenient to separate the agricultural area (arable fields, meadows, and pastures) from the forest area, and both from the area of freshwater fisheries, dividing each group into four zones. In subdividing the agricultural area into its four constituent zones, the distance from the market, the means of communication, and the price of agricultural produce, more especially that of fresh milk sold off the farm, are used. In subclassifying the forest area into its constituent zones, the price of the wood is of chief importance, position and the condition of the forest roads being of minor importance.

For unfavourable conditions which cannot be taken into account in the various classes and zones, such as occur, for instance, when crops are intermixed instead of being continuous, or when fields of one farm are mixed with those of another farm, when the supply of drinking water is not

good, etc..., suitable deductions may be made from the established mortgage value of the land; these deductions must not exceed certain limits which are defined by regulations. Deductions from the amount of credit to be granted should also be made for a faulty economic condition of the farm, for by this means the number of forced sales would be reduced, and it would also prevent the mortgages on such incompletely equipped estates from exceeding two-thirds of the value estimated by the "Landschaft" (agricultural credit association), a proceeding which is contrary to the laws and statutes of those credit institutes.

The mortgage value of buildings is best estimated from the values fixed by fire insurance societies and from the normal relationship between the value of the living-house and that of the farm buildings on the one hand and the normal relationship between the value of all the buildings and that of the land on the other. These normal relationships may be altered by the addition of supplements in cases where industrial plant or numerous cottages in a good state of repair exist on the estate.

279 - **An Example of Agricultural Book-keeping on the Card System.** — GUFFROY, CH. in *Journal d'Agriculture pratique*, Year 78, Vol. 1, No. 1, pp. 13-16. Paris, January 1, 1914.

The writer discusses the advantages of this system, which can be used with all the usual systems of agricultural book-keeping, and which consists in writing on separate cards all the events of the farm, commercial transactions, single accounts, etc. With the aid of an actual example, he illustrates the entries on the cards and the method of using them.

AGRICULTURAL INDUSTRIES.

DAIRYING.

280 - **The Condition of the Dairy Industry in the Argentine Republic in 1912.** — *Communication from* EMILIO LAHITTE, *of the Ministry of Agriculture of the Argentine Republic, Bureau of Statistics and Rural Economy.*

A simple comparison of every series of statistical data on the dairy industry in the Argentine Republic during the year 1912 with those of the preceding year shows that the normal condition of live stock during 1912 was accompanied by good results as regards production, and much superior to that of 1911. The figures are shown in the table.

Raw material. — Of the 68 ½ million gallons of milk in the industry, the province of Buenos Aires supplied 71 per cent. During the year in question the prices per gallon varied from 2.8 *d* in December to 7.1 *d* in July (prices at the farm). Considering an average price of 3.8 *d* per gal., the total value of the raw material amounted to £1 089 000.

Cream. — As is to be expected, the province of Buenos Aires is the greatest contributor under this head: 23 112 000 lbs. out of a total of 37 455 500 lbs. (61 per cent. of the whole). The relatively short distances from the federal capital, the easy means of communication and the presence of important centres of consumption, explain the great number of cow farms and

	1911	1912	Increase in 1912 over 1911
			per cent.
Production of:			
Cream . . . . lbs.	26 605 000	37 455 500	40.8
Butter . . . . »	17 427 000	21 818 500	25.2
Cheese . . . . »	7 305 000	12 416 000	60.2
Ewe's milk cheese . . . . »	?	110 000	—
Casein . . . . »	?	11 590 000	—
Number of:			
Milk dairies	1 160	1 259	8.5
Cream »	398	525	31.9
Butter »	10	16	60.0
Cheese »	158	129	22.5
Mixed »	329	369	12.2

dairies in the province of Buenos Aires; in the province itself, however, the dairies are mainly in the southern and western districts within about 200 miles of the capital.

Butter. — The four great butter manufactories established in the capital turned out 13 586 500 lbs., that is 62 per cent. of the whole output of the country. The average sale prices at the works varied considerably according to the season, as is shown by the following data :

1912	*s*	*d*
Price of butter per lb. in:		
January, February and March	1	0
April	1	0 ¼
May	1	1
June and July	1	7
August	1	3 ¾
September	1	0
October		11 ½
November		10 ¼
December		9 ½

As the prices between April and August may be considered exceptional on account of the drought, which to a great extent diminished the production, a price of 1*s* 1 ¼ *d* is taken as an average for the whole of 1912. The total value of the butter is thus £1 207 000.

Cheese. — In this item the increase of the quantity produced in 1912 over that of 1911 is considerable (12416 300 lbs. against 7 745 900 in 1911). The provinces of Buenos Aires and Cordoba contributed largely to this increase, especially the latter, in which the yield rose from 758 568 lbs. in 1911 to 1 412 276 lbs. in 1912. The price at the dairies may be valued at

5 ³/₄ *d* per lb., which would give the value of the cheese produced in 1912 as £294 400.

It would be difficult to state exactly the type of cheese that is produced. Nevertheless it may be said that, excepting such cheeses as Tafi, Chebut and the like, there is no commercial type, and in general only very successfull imitations of all known kinds are manufactured. Still the figures which will be given below show that these imitations do not prevent considerable importations and that the Argentine consumers prefer the original cheeses of certain determined countries. In fact the imports of all cheeses during the five years 1908-12 amounted to 49 200 000 lbs., worth £1 767 500. In 1912 the imports were 11 849 000 lbs., worth £425 667. As for the countries whence the cheese is exported, Italy has an undoubted supremacy, having supplied 79.3 per cent. of the total in 1912; next follow Switzerland, Holland, France.

Casein. — In view of the increasing importance of the production of this substance, the statistics have minutely investigated its output. The production of 11 590 000 lbs. shows to what an extent the industry has availed itself of skimmed milk in order to meet the steady demand for this substance, which has successfully replaced other industrial products, and which, owing to the prices it commands on the market, yields a fair net profit to the producers.

The province of Buenos Aires is the chief producer of casein. Out of a total of 11 590 000 lbs., it has supplied 5 214 500 lbs., or 45 per cent.; it is followed by the Federal capital with 4 189 000 lbs. and Santa Fé with 1 573 250 lbs. The following table, which shows the quantities exported from Argentina during the last five years, gives an idea of the future there is for this industry:

	lbs.	Value
1908	8 461 300	£35 860
1909	6 117 100	48 350
1910	6 553 600	51 800
1911	4 780 300	37 780
1912	7 717 100	60 990

According to commercial information, the value of this substance at the works may be estimated at £138 600, or £26 10*s* per ton.

Whey. — On the answers received to an enquiry, 75 per cent. state that whey is used in the feeding of pigs, that is in the production of pork. It is not easy to determine the value of the whey thus transformed, notwithstanding the fact that the quantities used for this purpose are known; there is no doubt that it runs up to some thousands of pounds.

Summarizing, the values for 1912 work out as follows:

Value of the butter	£1 207 000
» » » cheese	294 500
» » » casein	138 500
» (calculated) of the other products and by-products	23 000
Total value of the produce of the dairy industry	£1 663 000

281 – **The Decomposition of Milk Proteins by Lactic Ferments.** — DE GRAAFF, W. C. and SCHAAP, A. in *Annales des Falsifications*, Year 6, No. 62, pp. 639-645. Paris, December 1913.

In working out a new method for the quantitative determination of the proteins in milk the writers ascertained that the aldehyde index of buttermilk averages 1.5 times greater than that of fresh milk. The cause of this is assumed to be a decomposition of the protein in the buttermilk. Recent investigations made in this direction have confirmed this assumption and shown that fresh milk never contains albumoses and peptone, which are always found in buttermilk. In order to ascertain through what agency protein was decomposed, the writers investigated the effect of rennet and of lactic acid upon the aldehyde index of milk. It appeared that even after 24 hours rennet has no effect upon the aldehyde index; nor did lactic acid, alone or combined with rennet, have any. It can therefore be assumed that the decomposition of protein is not accomplished by rennet or by lactic acid but by the micro-organisms in the milk.

The writers consequently studied the growth of the microflora, both with the exclusion and with the admittance of air; then they treated fresh milk with buttermilk and finally they isolated lactic acid bacteria (cocci and bacilli) from buttermilk and introduced them into sterile milk. The result was that both in the presence and absence of air nearly the same milk flora developed, from which the conclusion to be drawn was that it consisted mainly of lactic acid bacteria. The addition of butter milk to fresh milk was regularly followed by an increase of the aldehyde index of the latter. The inoculation with lactic acid bacteria isolated from buttermilk caused after a short time a decomposition of protein in sterile milk.

From the above observations the writers draw the following conclusions:

1. The aldehyde index of buttermilk is higher than that of fresh milk, which is to be attributed to a decomposition of the protein in buttermilk by lactic acid bacteria (principally cocci and bacilli).

2. Besides lactic acid bacteria, milk contains other proteolytic bacteria, but these are in too small numbers to alter the aldehyde index.

282 – **Composition of Ewes' Milk Butter.** — MARTIN, M. in *Annales des Falsifications*, Year 6, No. 62, pp. 662-663. Paris, December 1913.

The writer communicates the results of analyses of ewes' milk butter prepared in the district authorized laboratory at Rodez (Aveyron, France). The fresh milk was supplied by an inspector of the dairies of the "Société des Caves et Producteurs réunis" of Roquefort. It came from the flocks of four farmers whose respectability was a guarantee of the purity of the milk. The samples were obtained from two of the farms each week, so that the same milks returned to the laboratory once every fortnight.

Ewes' milk butter is generally very white, soft and difficult to work and to dry. Its defective appearance banishes it from the table, in spite of its fine taste. It is not rare, however, to find it mixed in various proportions with cows' milk butter on the markets of the Roquefort cheese district. It is very suitable for cooking and for pastry.

Its chemical composition is very nearly the same as that prepared from cows' milk, but the content of insoluble volatile acids and saponification value are decidedly higher. There are nevertheless considerable variations. It is certainly impossible to characterize by means of these data alone a mixture of cows' milk and ewes' milk butters, and still less to determine the proportion of each. The following table shows the figures found by the writer in ewes' milk butter.

	Volatile acids					Total soluble acids		Values		Deviation of oleorefractometer	Refractive index
	soluble *	insoluble	ratio $\frac{i}{s} \times 100$	solubles (Reichert)	insoluble in $\frac{Na\ OH}{10}$	in cc. $\frac{Na\ OH}{10}$	in butyric acid, per cent.	saponification	Crismer		
Average	5.26	0.84	15.6	28.48	4.40	23.6	12.5	231.58	54.86	— 29	1.45215
Maxima	5.88	1.07	19.7	31.82	7.01	27.9	14.73	242.60	59.99	— 24.5	1.4532
Minima	4.67	0.67	11.5	25.65	2.53	21.6	11.4	216.31	47.09	— 33	1.4511

* The figures of the first three columns were found by Muntz-Coudon's method and those of the other columns by the official method.

MEAT INDUSTRY.

283 - **Composition and Properties of Some Casein and Paracasein Compounds and their Relations to Cheese.** — VAN SLYKE, L. and BOSWORTH, A. W. — *New York Agricultural Experiment Station, Technical Bulletin* No. 26, pp. 1-32, Geneva, N. Y., December 1912.

Two new compounds of casein and paracasein (casein precipitated by rennet) with calcium have been prepared and are described. The new compounds contain smaller amounts of base than any other known compounds, and the writer suggests their being called " mono " and " di-basic caseinates " or " paracaseinates ". Mono- and di-basic salts of barium and strontium were also prepared and mono-basic salts of ammonium, sodium and potassium.

The paracaseinates contain twice as much base as the caseinates and the valency of the latter appears to be 8, while that of the former is only 4, which seems to suggest that the action of the rennet enzyme is to split the casein molecule into two.

A protein formed in the process of manufacture of Cheddar and other cheeses and soluble in a 5 per cent. salt solution is identified with mono-calcium paracaseinate.

284 - **The Amount of Bone in Animals for the Slaughterhouse.** - TRIDOR in *L'Hygiène de la Viande et du Lait*, Year 8, No. 1, pp. 18-22. Paris, January 10, 1914.

The proportion of bone (that is the ratio of the weight of the bones to the total weight of flesh and bones) in animals taken to the slaughterhouses is very variable; the weight of bone reaches and sometimes exceeds one-third of the total weight of the animal. In full-grown cattle, which have

been most studied from this point of view, the percentage of bone varies with the breed.

The writer has made investigations on calves and sheep in order to ascertain whether there was any connection between the weight of bone and the age, quality and weight of the animals.

I. *Influence of age.* — An examination of the carcases of nine calves which had been seized in the Paris market because too young, showed that the percentages of bone varied from 29.6 to 33.4, while in other somewhat older calves the lowest proportions found were 20.6 and 21.9 per cent, or a difference between the extreme cases of 12.8 per cent.

With sheep, a first series of observations bore on 12 animals which had been seized for their cachexy and leanness. The extreme percentages of bone were 30.4 and 26.9, the average for six lambs and a young ewe being 34.2 and that for five older sheep 29.6 In a second series of observations on animals of good quality, one lamb was found which yielded 24.25 per cent. of bone, whilst two older ewes and one ram gave respectively 15.2, 16.7, and 18.4 per cent., or an average of 16.75 per cent.

In calves and sheep it thus appears that the proportion of bone is higher in the younger animals.

II. *Influence of quality.* — As for calves, various weighings have given the following results :

	Percentages Extremes	Average
9 young calves of very poor quality	29.1 — 33.4	31.8
3 calves of poor quality	26.8 — 29.6	28.25
3 » of 2nd and 3rd. quality	24.3 — 27.7	26.1
3 » 1st class quality	20.6 — 26.2	22.9

In mutton the proportions of bone were:

	Percentages Extremes	Average
6 lean and cachetic lambs	30.4 — 36.1	33.9
6 » » » wethers and ewes	26.9 — 36.4	30.75
1 lamb, 2nd quality		24.25
4 wethers or ewes, 1st quality	15.2 — 22.3	18.15

It thus appears that in calves and sheep the quantity of bone varies inversely with the quality of the animals.

III. *Influence of the weight of the animals.* — The weights recorded in the preceding experiments afford information as to the connection between the quantity of bone and the total weight of the animals. The calves yielded the following results.

	Percentages Extremes	Average
6 calves weighing less than 44 lbs.	30.6 — 33.4	32.5
3 » » from 44 to 66 lbs.	29.6 — 32,2	30.5
6 » » » 66 to 132 »	24.3 — 29.6	27.2
» » upwards of 132 lbs.	20.6 — 21.9	22.9

Examinations of legs of beef have shown that the decrease of the percentage of bone continues sensibly with the increase of the weight of the animal.

With wethers the following figures were obtained :

	Percentages	
	Extremes	Average
9 animals weighing less than 22 lbs.	24.3 — 36.1	31.7
5 „ „ between 22 and 44 lbs. . .	22.3 — 36.4	29.8
3 „ upwards of 44 lbs..	15.2 — 18.4	16 75

The results obtained appear constant with calves, grown up cattle, and sheep, and may be summarized as follows: the proportion of bone to the total weight of the animal varies inversely with the age, the quality and the weight.

PLANT DISEASES

GENERAL INFORMATION.

285 - **Diseases and Pests Legislation in Ceylon.** — PETCH, T. in *Department of Agriculture, Ceylon, Bulletin* No. 6, pp. 79-93. Colombo, 1913.

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

At the present time there are in Ceylon two Ordinances dealing with local plant diseases and preventing the introduction of others. It was not until 1901 that some simple form of legislation was considered necessary to regulate the importation of plants and seeds. Before then these was no law dealing with plant diseases, while other tropical colonies were taking measures against the coffee leaf disease in Ceylon. Since then progress has been rapid, and Ceylon has outrun other tropical countries in adopting a general Ordinance to provide against diseases occurring in the colony.

The writer gives the full text of the legislative provisions concerning plant diseases as outlined in " Ordinance No. 5. of 1901 " entitled " An Ordinance to make provision for preventing the introduction and spread of Insect or Fungous Pests or Plant Diseases ", known as " The Insect Pest and Quarantine Ordinance ". Next follow the various regulations in connection with the said Ordinance extending over the period 1901-1912 to prevent the introduction into Ceylon of fungus diseases and animal pests from other regions and for the institution of a Fumigating Station.

As a result of the regulations already in force, the importation of cacao plants from the Dutch East Indies and pepper from India is absolutely prohibited. All plants, bulbs, etc., except those imported for local consumption, oranges and other citrus fruits and cotton seeds, are subjected to fumigation by means of hydrocyanic acid, unless certified as having been previously subjected to such treatment. Tea seeds are disinfected by means of formalin vapour. During 1912, 1148 cases of oranges and lemons, 4977 cases of tea seeds and 565 consignments of bulbs, plants, etc., were fumigated.

Internal Legislation was contemplated in " Ordinance No. 6 of 1907 ", known as " The Plant Pests Ordinance of 1907 ", of which the whole text is given, representing the result of discussions held by those affected during various years. The " Ordinance " is accompanied by certain Proclamations issued at various imes during 1907 to 1913 describing the methods of controll-

ing fungus diseases and insect pests. Since these Proclamations have not been repealed, power has been given to the Plant Pests Board, set up in each district by the " Ordinance of 1907 " to take steps for the control of coconut beetles, in particular *Rhynchophorus signaticollis* (the red coconut beetle) and *Oryctes rhinoceros* (the black coconut beetle) against the stem-bleeding disease of the coconut (*Thielaviopsis ethaceticus*), against the shot-hole borer (*Xyleborus fornicatus*) and Hevea canker (*Phytophthora Faberi*).

286 — **List of Proclaimed Noxious Weeds in Tasmania.** — *The Agricultural Gazette of Tasmania*, Vol. XXI, No. 11, p. 437. Hobart, 1913.

Botanical name	Local name	When proclaimed
Cnicus arvensis Hoffm.	Californian thistle	29 Oct. 1883
Xanthium spinosum L. (1).	Bathurst burr	20 Dec. 1887
Lepidium Draba L.	White weed	29 Oct. 1908
Cryptostemma calendulaceum Br. . .	Cape weed	31 Aug. 1909
		17 Nov. 1909
		20 Dec. 1910
		11 May 1911
Arctium Lappa L.	Great burdock	1 July 1910
» *minus* Bernh.	Lesser burdock	
Asphodelus fistulosus L.	Wild onion	29 Sept. 1910
Brassica Sinapistrum Boiss.	Charlock	20 Dec. 1910 *
Conium maculatum L.	Hemlock	3 Feb. 1911
Echium vulgare L.	Viper's bugloss	4 March 1912
Dipsacus sylvestris Mill. (2).	Teazel	21 March 1912*
Anthemis Cotula L. (3)	Stinking mayweed	27 March 1913*
Carduus pycnocephalus Jacq. (4). . .	Slender or shore thistle	14 Oct. 1913*

* Proclaimed only in certain municipalities.

287 — ***Carduus pycnocephalus* a Proclaimed Weed in Tasmania.** — BLACK, R. A. in *The Agricultural Gazette of Tasmania*, Vol. XXI, No. II, pp. 430-435, figs. 1-2. Hobart, 1913.

As the outcome of a strong recommendation made by the Clarence Board of Agriculture to the local Council, the slender thistle (*Carduus pycnocephalus*) was proclaimed a noxious weed under Section 6 of the Local Government Act, 1906.

This species has been found in many parts of Tasmania, particularly near the coast or even growing on the beach, whence the name of "shore

(1) See also No. 1403, *B.* Dec. 1913. — (2) See No. 1363, *B.* Sept. 1912. — (3) See No. 1096, *B.* Sept. 1913. — (4) See below, No. 287. (*Ed.*).

thistle " sometimes given to it. If left undisturbed it will grow with great rapidity and spreads very quickly owing to the various ways by which its seed is dispersed. Repeated observations show that cattle only eat it accidentally mixed with other fodder, or in times of shortage.

In consequence of the law it is incumbent upon the municipality of Clarence to take action for its eradication. Section 3 of " The Californian Thistle Act, 1883 " (47 Vict, No. 17), as read with Subsection XII of Section 130 of " The Local Government Act, 1906 " provides : — " If any occupier of land within (the Municipality of Clarence) upon which land (Slender Thistle) shall be growing at any time shall not effectually cut down all such (Slender Thistle), so as to prevent the same from blossoming, every such occupier shall be liable to a penalty not exceeding Twenty Pounds ".

Section 3 of " The Californian Thistle Act Amendment Act, 1887 " (51 Vict., No. 29), as read with Subsection XII of Section 130 of " The Local Government Act, 1906 ", forbids the removal or sale of hay, straw, grass seed or any kind of grain containing seeds of slender thistle.

Finally " The Federal Quarantine Act " prohibits the importation of the plant or its seeds from any part of the world into the Commonwealth of Australia under a severe penalty.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

288 - **On " Kroepoek " of Tobacco in Kamerun.** — LUDWIGS, KARL in *Berichte der deutschen botanischen Gesellschaft*, Vol. XXXI, Part 9, pp. 536-543, figs. 1-3. Berlin, 1913.

In the spring of 1913, a tobacco disease which had already appeared in the previous spring, and was known to tobacco cultivators under the name of " Kräuselkrankheit " (leaf curl), was very prevalent in Njombe. From observations made on the spot, the writer ascertained that the disease in question was not the true " Kräuselkrankheit ", but " Kroepoek ", which at first sight appears very similar to the former affection ; according to Peters it occurs in Java, and more rarely in Sumatra, while it is probably present in Ceylon. The cause of this disease, together with the means of its control, have so far not been discovered.

Already on the young plants the central leaves are seen to develop abnormally, since instead of assuming a vertical position as in healthy plants, they curve partially, rotating horizontally. The upper surface of the leaf has a wrinkled appearance, while the nerves on the lower surface are especially marked and show on their margins excrescences of dark green tissue. The leaves no longer develop normally in length, but give the impression of being contracted into themselves ; further, they are not straight, but bent, and subsequently the interposed foliar tissue forms protuberances which are directed upwards. In the older leaves, the excrescences have the appearance of leaflike appendices, having an anatomical structure differing from that found in the normal organ. The size and shape of these outgrowths vary, but they are always connected with the principal nerves,

or with the more marked secondary ones. The development in length of the whole plant is arrested, infected individuals only attaining to about one third of their normal height, while their leaves are valueless to the grower.

Microscopic investigations have not revealed the presence of any bacteria, fungi or insects. Various experiments were also made with potassic manures; these, however, gave no results. The soil upon which the tobacco plantations have been made consists of decomposed basalt and is very fertile. The alternation of good with bad crops (from the autumn of 1911 in which the first sowings were made, until the spring of 1913), according to whether the tobacco was planted after the rains, or at the close of the dry season, an alternation which was proved to occur not only at Njombe, where there are the oldest and largest tobacco plantations, but also at Mbanga and Ebunje (Ebinse), strengthened the writer's belief that the degree of humidity of the soil exercises an influence upon the appearance of "Kroepoek", in so far that it is a physiological disease depending on disturbance in the nutrition of the plant. These disturbances, in the opinion of the writer, are connected with the peculiar structure of the soil. The subsoil of the plantations attacked by the disease consists of masses of rock of varying size covered by a stratum of fine volcanic ashes, which at Penja attains a depth of about 20 m. (66 ft.) These ashes, although in themselves very fertile, possess the disadvantage of being permeable to water to an extraordinary degree. The sources of all the streams in the district are situated at great depths, and occur at the spots where the masses of rock crop out. It is impossible to dig a well in the plantations on account of the rocky subsoil.

This peculiar structure of the ground prevents deeply seated water from reaching the surface by capillarity; to this must be added the method by which the soil is prepared previous to the planting of the tobacco. All the district is covered by a thick virgin forest which assures to the soil a certain amount of moisture. In order to make a tobacco plantation, it is necessary to fell the virgin forest and completely clear the ground by working it repeatedly. It is easy to understand that the soil loses the greater part of its moisture during these operations, especially in the dry season, and dry soil, as is well known, only acquires moisture with great difficulty. Such are the conditions under which the tobacco plantations occur. After the first felling of the forest, which usually took place towards the close of the dry season, the soil still held sufficient moisture; the atmospheric precipitations of the rainy season followed, and a good crop resulted. Afterwards, the soil was exposed to the sun, the water evaporated without being replaced and the plants consequently became diseased.

According to the writer, the appearance of the disease may be explained as follows. The tobacco plants are first grown in seed plots, whence they are later transplanted to the field. In order to facilitate their taking root, they are generally watered, so that they may continue growing and attain a certain height. After this, the watering is suspended, and the plants are left to themselves. In this condition they form organic substances in

their leaves, through assimilation, but they no longer receive mineral substances from the ground, as the necessary water is lacking. Consequently, the water-conducting vessels do not develop normally, the leaves become shrivelled, and the excess organic substances are used in the formation of the excrescences and the appendices which are observed on the leaves.

It is noteworthy that, at least according to the researches hitherto made, the plant which has once become diseased never regains its normal development, even if subsequently supplied with water.

The observations made exclude the possibility of affected plantations yielding any crop the same season.

In 1913, the writer advised for the control of the disease, the covering of the soil, after clearing it, with about 18 inches of cut grass; this decomposes forming humus, and thus preserves the moisture for a long time. The results of these experiments are awaited with interest. In any case it would be foolish to abandon tobacco growing, even if a bad harvest is obtained after a moderately wet rainy season, such as was experienced in 1913.

In the Esosung plantations, on the other hand, the soil is also volcanic, but as it contains clay it retains water better. Further, the humidity of the air its such that the soil cannot possibly dry up. In this district, the disease has not made is appearance, and it is possible to plant two tobacco crops in the year.

The writer states, in conclusion, that "Kroepoek" does not only attack tobacco, for he has met with it to a considerable extent also upon plants of "makabo" (*Colocasia antiquorum*) growing upon dry soil near the village of Lum. Doubtless the disease could also be recorded as attacking other plants.

289 – **On the Pathological Significance of Endocellular Fibres in the Tissues of the Vine** (1). — MAMELI, EVA in *Atti dell'Istituto botanico dell'Università di Pavia*, Series II, Vol. XVI, pp. 41-45. Milan, 1913.

According to what is reported in this second note on the subject (the full results of the complete investigations will be published later) the search for endocellular fibres in the healthy tissues of numerous species of "perfectly healthy" dicotyledons has given the writer positive results.

Further, more or less numerous endocellular fibres have been found in the tissues of healthy vines which have been cultivated under the most diverse climatic conditions, from a mountain 650 metres (2170 ft.) above sea-level down to a hot-house.

Contrary to the opinion of Petri, it seems evident, according to the writer, that no correlation exists between the presence of endocellular fibres and any pathological condition of the plant containing them, nor is there any connection between this phenomenon and falls of temperature.

(1) See No. 1207, *B.* Oct. 1913; No. 1394, *B.* Dec. 1913. *(Ed.)*.

BACTERIAL AND FUNGOID DISEASES.

FUNGI.

290 - **The Hereditary Transmission of Rust in Hollyhock *(Althaea rosea).*** — BLARINGHEM, L. in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 26, pp. 1536-1538. Paris, December 29, 1913.

Seeds of *Althaea rosea* sterilised externally and grown in sterile tubes containing Knop's solution (either liquid or solidified by Japanese isinglass) gave rise to plants quite free from pustules of hollyhock rust (*Puccinia Malvacearum*). The addition of 5 per cent. of glucose to the nutritive solution caused the appearance of pustules on the cotyledons several days before they withered off. An addition of 5 per cent. of saccharose gave more vigorous plants, and the pustules appeared on the first leaf when it was drying off. The supply of glucose and saccharose was arranged so that the plants were in a medium physiologically poor in water (Schimper). The writer considers that the above results can only be attained when the illumination is as intense as the walls of the vessel will permit.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

291 - **The Fungi causing Straw Blight of Wheat in France.** (1) — PRUNET, A. in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 22, pp. 1079-1081. Paris, 1913.

Straw blight in France has so far only been considered in relation to wheat; it has been regarded by Prillieux and Delacroix as chiefly due to *Ophiobolus graminis* Sacc., although Mangin and Fron consider the pathogenic agent to be almost exclusively *Leptosphaeria herpotrichoides* De Not. In Central Europe, and more especially in Germany, it appears that *O. herpotrichus* (Fries) Sacc. is chiefly responsible for straw blight in wheat and barley, while *L. herpotrichoides* produces straw blight in rye.

The presence in France of *O. herpotrichus* has not been recorded by the observers of straw blight, with the exception of Delacroix who mentions it incidentally, and the part played by this species in the development of the disease in that country has not been investigated. Nevertheless, *O. herpotrichus* was almost the only species observed by the writer in the district of Toulouse in 1912-1913. In particular, this fungus caused much damage at Saint-Jory and at Ondes (Haute-Garonne). The writer also almost inveriably found it alone on diseased wheat straw from Causé (Tarn-et-Garonne) and Castillonnes (Lot-et-Garonne). He is of opinion that *O. herpotrichus* is also present in other grain-growing districts of France, and in fact, it was recorded in Poitou and from various places in Charente Inférieure in 1856 and 1884 respectively, throughout the Vosges in 1845, and frequently near Paris (at Versailles and Fontainebleau) in 1863.

In the season of 1912-13 *O. graminis* took the place of *O. herpotrichus* in the neighbourhood of Queyssac (Dordogne). In all the above-mentioned places *L. herpotrichoides* has rarely made its appearance. Mangin, and subsequently Fron, have, however, found this species abundant elsewhere.

(1) See also No. 77, *B.* Jan. 1914. [*Ed.*].

Wheat straw blight in France is there fore usually due to one of the three following species: *O. graminis, O. herpotrichus, L. herpotrichoides*. It would be premature to state the relative importance of these three fungi as pathogenic agents. Further, there is no proof that the species which predominates in a district at any given moment will always predominate there.

Hence it results that the name of "piétin" is in fact given to three different diseases, and this confusion in nomenclature gives rise to serious difficulty, since it causes the confusion of facts. The three straw blights possess as their common characteristic the habit of invading the base of the haulms, but the study of their life-history is too little advanced for it to be possible to determine with any certainty the points in which they differ from one another.

It has already been observed that their organs of reproduction are not formed at the same time, and that the different species have a preference for wheat, rye or barley respectively. The writer adds that oats, which, according to Mc Alpine and Robinson, are immune to *O. graminis*, have in theneighbourhood of Ondes been very severely attacked by *O. herpotrichus*. Without doubt, these are not the only differences; they are, however, sufficient to show that each straw blight should be studied independently of the others.

INSECT PESTS.

292 — **The Insect Fauna of the Soil.** — CAMERON, ALFRED E. in *The Journal of Economic Biology*, Vol. 8, No. 3, pp. 159-204, plates I-II, figs. A-C. London, September 29, 1913. GENERALITIES.

The writer has made a thorough investigation of the insects inhabiting the soil of a grass field attached to the Economic Zoology Laboratory of the University of Manchester. The surface soil is much mixed, but is everywhere underlain by stiff clay. Much of the area was dug over to a depth of 1 to 2 feet, and carefully sifted.

The herbage of the field was composed of a number of grasses and weeds. Larvae of insects found feeding on the roots of the useful grasses and Leguminosae were as follows:

Dactylis glomerata: Hepialus humuli, Leucania comma.

Festuca duriuscula and *F. elatior: Dolerus gonager, D. haematodis, D. picipes.*

Poa annua and *P. pratensis:* Cecidomyidae, Mycetophilidae, Tipulidae (prevalent *Dicranomyia chorea, Trichocera hiemalis, Pachyrrhina imperialis, Tipula oleracea*), Bibionidae (especially *Dilophus febrilis*; also *Bibio hortulanus, B. laniger* and *B. johannis*); Muscid Diptera (*Onesia sepulcralis, Pollenia rudis, Hyetodesia incana, H. populi*); Elateridae; *Otiorrhynchus picipes, O. sulcatus, Barynotus obscurus;* various species of Noctuidae (*Triphaena, Xylophasia, Hadena, Hydroecia*).

Phleum pratense: *Apamea gemina*.
Trifolium pratense and *T. dubium*: *Agrotis corticea*.

Those on roots of weeds were chiefly Noctuids (*Leucania, Apamea, Triphaena, Agrotis, Xilophasia, Mamestra*).

In breeding the various insects found in the soil, a number of parasites were reared; the following are from new hosts: *Homocidus dimidiatus* Schr. and *H. tarsatorius* Panz. (Ichneumonidae, Tryphoninae) from pupae of *Platychirus albimanus* F. (the host being useful in the larval state in destroying *Pterocallis tiliae*, the aphis of lime trees); *Phaeogenes* sp. (Ichneumonidae, Ichneumoninae) from pupae of *Chrysopa vulgaris* L. (also useful in destroying lime aphis).

In the second part of his article the writer mentions that to most soil insects clay is unfavourable, as it hinders their movements; this is particularly the case with active larvae like those of the predaceous Carabidae and Staphylinidae, while wireworms and leather-jackets seem to thrive in heavy clays. The question of aeration is of importance in this connection: most insects remain near the surface (out of the 140 species found in the field hardly 20 occurred at depths below 6 inches), but the larvae of *Hepialus humuli* burrow down as deep as 18 inches to pupate.

Stagnant water destroys the majority of insects; an exception is provided by the larvae of *Agriotes lineatus* (wireworm), which in the writer's experiments were alive after immersion in water for six days, though nearly all were dead after eight days.

Many insects burrow deep into the soil during cold weather; but others remain dormant near the surface; larvae of *Triphaena pronuba* and *Agrotis segetum* and of certain Muscids found in frozen soil recovered indoors and eventually completed their metamorphoses.

The article is accompanied by a bibliography referring to a large number of works.

293 - **A List of Uganda Coccidae and their Food-Plants.** — GOWDEY, C. C. in *Bulletin of Entomological Research*, Vol. IV, Part 3, pp. 247-249. London, November 1913.

The climate and the luxuriant vegetation of Uganda render it a particularly favourable country for the development of insect life. Insect growth and multiplication are therefore continuous throughout the year. This is especially true with regard to the Coccidae.

Many of the forty-nine species enumerated by the writer have been found upon cultivated plants:

Icerya sp.	Orange.
I. caudatum.	Crotons.
I. seychellarum Westw.	*Monodora myristica* and *Eranthemum bicolor*.
Dactylopius sp. nov.	Unknown shrub.
D. (Pseudococcus) citri Risso.	Coffee, orange and lemon and an unknown shrub.
Tachardia decorella Mash.	*Anona muricata*.
T. longisetosa Newst.	Bark-cloth tree (*Ficus Sycomorus*).
Pulvinaria sp. nov..	*Tecoma stans*.
P. jacksoni Newst. (Parasitized by *Tetrastichus gowdeyi* Crawf.).	Cotton.

P. psidii Mask.	Coffee, *Funtumia elastica*, guava, tea, *Alternanthera versicolor* and *Markhamia platycalyx*.
Ceroplastes sp.	Guava.
Ceroplastes sp. nov. (two).	Bark-cloth tree.
C. africanus Green.	*Acacia* sp. and *Cajanus indicus*.
C. ceriferus And.	*Antignon leptopus*, orange, coffee, *Funtumia latifolia*, tea, canna, croton, Agave, Hibiscus and bark-cloth tree.
C. coniformis Newst.	*Ficus* sp.
C. destructor Newst.	Guava.
C. ficus Newst.	Bark-cloth tree.
C. galeatus Newst.	Coffee and bark-cloth tree.
C. quadrilineatus Newst.	*Anona muricata* and Nsambyia (*Markhamia platycalyx*).
C. singularis Newst.	Guava.
C. ugandae Newst.	*Acacia* sp. and *Anona muricata*.
C. vinsonioides Newst.	*Baikea eminii*, coffee and guava.
Inglisia conchiformis Newst. (parasisized by *Eublemma scitula* Ramb.).	*Anona muricata* and *Harrogania madagascariensis*.
Ceroplastodes gowdeyi Newst.	Bark-cloth tree.
Lecanium africanum Newst.	Coffee.
L. elongatum Sign.	*Albizzia* sp. and *Cajanus indicus*.
L. (*Eulecanium*) *filamentosum* Newst.	Unknown forest shrub.
L. (*Eulecanium*) *somereni* Newst.	Mulberry, *Tecoma stans*, and *Markhamia platycalyx*.
L. (*Coccus*) *hesperidum* L.	Orange.
L. (*Saissetia*) *nigrum* Nietner.	*Ficus* sp. and *Anona muricata*.
L. (*Saissetia*) *oleae* Bern.	*Chlorophora excelsa*.
L. tenuivalvatum Newst.	Elephant grass and lemon grass.
L. viride Green (preyed on by *Chilocorus discoideus* and *C. punctata*).	Coffee and guava.
Stictococcus dimorphus Newst. (parasitized by *Eublemma costimacula* Saalm.).	*Cajanus indicus*, cacao, *Croton tiglium*, *Anona muricata*, *Markhamia platycalyx* and mulberry.
S. gowdeyi Newst.	*Harrogania madagascariensis* and coffee.
Chionaspis cassiae Newst.	*Cassia floribunda*.
C. dentilobis Newst.	Palms and *Sapium mannianum*.
C. substriata Newst.	Palms.
Diaspis (*Aulacaspis*) *chionaspis* Green.	*Sapium mannianum* and *Cassia floribunda*.
D. regularis Newst.	*Chlorophora excelsa*.
Aspidiotus cyanophylli Sign.	Guava, palms.
A. cydoniae Comst.	Guava.
A. gowdeyi Newst.	*Anona muricata*.
A. transparens Green.	Tea.
A. trilobiformis Green.	Oleander.
Lepidosaphes beckii Newm. (*citricola* Pack).	Orange, lemon.
Ischnaspis filiformis Dougl.	Palms and bamboo.
Gymnaspis africana Newst.	Unknown forest shrub.

294 - ***Diaretus (Aphidius) obsoletus* n. sp., a Braconid Parasitic upon the Aphides *Brachycolus noxius* and *Toxoptera graminum*, injurious to Cereals in Russia.** — KURDJUMOV, N. in *Revue Russe d'Entomologie*, 1913, Vol. XIII, No. 1, pp. 25-26, 1 fig. St. Petersburg, 1913. MEANS OF PREVENTION AND CONTROL.

A systematic description of this new Braconid (Hymenoptera), which has been studied at the Experimental Station of Poltava and is regarded by the writer as an important parasite of *Brachycolus noxius* Mordwilko and of *Toxoptera graminum* Rondani.

In Europe *D. obsoletus* takes the place of the American parasite of *Toxoptera*, *Lysiphlebus tritici* Ash.; it is near *Aphidius dauci* Marshall, from which it differs in certain morphological characters. Most probably, the parasite in question is a species confined to Southern Europe.

INSECTS INJURIOUS TO VARIOUS CROPS.

295 – **Insects and Mites Injurious to Cultivated Plants in France.** — NOEL, PAUL in *Bulletin trimestriel du Laboratoire d'Entomologie Agricole de la Seine Inférieure*, First Quarter 1914 (January-February-March), pp. 3-11. Rouen, 1914.

About 286 species of plants are cultivated in France; amongst these may be enumerated 16 kinds of fruit trees, 28 horticultural plants, 31 forage and cereal plants, 14 forest trees, 32 ornamental trees and shrubs, 84 ornamental plants and 91 medicinal plants. Each of these species has several enemies amongst insects and mites; the number of these enemies amounts to 1078 for oak, while for 25 other plants it reaches over a hundred.

The writer, who has studied agricultural entomology for forty years, has drawn up from the results of his own observations, and from data given in various works which have appeared in France from 1860 until the present day, some statistical tables for each of the seven categories of plants mentioned above. These show that the 286 kinds of plants which are cultivated in that country are attacked by as many as 12008 insects (Coleoptera, Orthoptera, Hemiptera, Neuroptera, Hymenoptera, Lepidoptera, Diptera) and mites, the numbers being divided as follows:

		No. of injurious insects or mites.
	16 fruit trees	1 071
	28 horticultural plants	704
	31 forage and cereal plants	988
	14 forest trees	4 637
	32 ornamental shrubs and trees	1 109
	84 ornamental plants	1 029
	81 medicinal plants	1 870
Total	286 cultivated plants	12 008

296 – **The Life-History of *Aphis euonymi*, Injurious to Sugar Beets** (1). — GAUMONT, L. in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, 1913, 2nd Half-year, Vol. 157, No. 22, pp. 1092-1094. Paris, 1913.

The writer, having found *Aphis euonymi* to be very abundant on the beets growing in the neighbourhood of Montargis (Loiret, France), set himself the task in 1912 and 1913 of verifying the results of the investigations made in Russia in 1909 by Mordwilko, and determining whether this aphis passes the winter only in the egg condition, and solely upon *Euonymus europaeus* and *Viburnum Opulus*, or whether it possesses some other method of hibernating.

In the Orleans public gardens the writer observed in 1912 and 1913 that *A. euonymi* was often very abundant on *Euonymus japonicus*.

(1) See also No. 395, *B.* July 1913. (*Ed.*).

In order to protect the beets, it would therefore not be sufficient, as has been maintained, to destroy *E. europaeus* and *V. Opulus*, but it would be necessary also to sacrifice *E. japonicus*, which is a very common shrub in public parks and gardens.

Further, according to the writer, this measure would not be all that is required, for at the end of October 1913, he observed beets still attacked by the aphis at St. Germain des Prés (Loiret). On the lower surface of the leaves were found wingless and winged parthenogenetic individuals, as well as sexual ones. The writer was able to collect a certain number of paired insects and oviparous females in the act of depositing their eggs at the base of the stems of the beets. When the latter are harvested the neck is left almost entire, or the leaves are stripped off, if they are used as forage ; then the beets are stored in silos or cellars. The eggs can thus remain upon the neck, and hatch out in the silos or cellars ; the aphids then find their way out through the ventilating apertures, spread in spring to *Rumex*, *Chenopodium* or other wild plants, and thus form centres of infection. If these beets are used for seed, the insects can easily found a new colony upon the plant on which they were hatched. On the other hand, young beets which are too small to be taken are often left in the ground ; these resist mild winters, and if they contain eggs, can easily in the spring become centres of infection.

297 - ***Aleurodes vaporiarum*, a Parasite of *Azalea indica* in Belgium** (1). — VAN HOVE in *Revue de l'Horticulture Belge et Etrangère*, Vol. XXXIX (Vol. IX, 4th Series), No. 24, pp. 392-393. Ghent, 1913.

This insect, which is well known to Belgian azalea growers under the name of " mouche blanche ", was very abundant in the autumn of 1913. According to the writer, it is necessary to have recourse to every method of destroying this pest, if the prohibition of the export of *Azalea indica* is to be avoided.

After having given some information regarding the life-history and habits of this parasite, and of the damage caused by it, the writer enumerates the preventive and curative measures to be adopted :

1) Fumigation with tobacco in the greenhouse; 2) spreading naphthalene upon heated plates in the greenhouse; 3) watering of azaleas planted out in the open with a mixture of soft soap, naphthalene, petroleum and tobacco juice ; 4) immersing the plants in a bath of lime water and insecticide ; 5) immersing the plants in a solution of soft soap and insecticide in the following proportions : 18 oz. soft soap, ½ oz. insecticide powder, and 3 ¼ gallons of water ; 6) the specialities recommended by the trade may be taken into serious consideration.

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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CONTENTS

FIRST PART: ORIGINAL ARTICLES

SECOND PART: ABSTRACTS

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

II. — CROPS AND CULTIVATION.

a) GENERAL

b) SPECIAL

III. — LIVE STOCK AND BREEDING.

a) GENERAL

b) SPECIAL

IV. — FARM ENGINEERING

V. — RURAL ECONOMICS.

VI. — AGRICULTURAL INDUSTRIES.

PLANT DISEASES.

I. — GENERAL INFORMATION.

II. — DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

III. — BACTERIAL AND FUNGOID DISEASES.

IV. — Parasitic and other Injurious Flowering Plants:

V. — Insect Pests.

a) General

b) Special

FIRST PART.

ORIGINAL ARTICLES

Present State of Plant Breeding in Denmark

by

H. A. B. VESTERGAARD,

Superintendent of Experiments, Abed, pr. Søllested.

The improvement of agricultural plants in Denmark is a recent departure. In reality it is only at the beginning of this century that real progress in this direction has been made and a definite plan has been followed. Before this time the only really successful work was that carried out by ERHARD FREDERIKSEN, who, under the influence of the work and progress achieved in Germany, introduced similar operations into this country. Frederiksen employed also the methods adopted by the best German breeders of that period : Beseler, Bestehorn, and Rimpau.

The best known varieties that he bred were the following :

Forage sugar beets, a cross between sugar beets and mangolds ; *hybrid barleys*, crosses between Imperial (*erectum*) and Chevalier (*mutans*), and lastly *Normal Squarehead wheat*. The latter was produced by ear selection from the older Scotch Squarehead introduced in 1874, which, in the course of years, inclined to degenerate. The method adopted was the one usual in other countries : Ear selection of the best types and breeding mixtures of the same. At present the above varieties are not much grown. The Normal Squarehead attained considerable importance, not only in Denmark but also in Sweden and Germany, where it served as a basis for the further work of improvement undertaken by Strube and Heine.

In considering present work and its results, it appears advisable to take each group of plants by itself.

Root crops. — Without considering sugar beets, which have not been subjected to improvement in Denmark, and the seeds of which are not produced in the country, the various kinds of mangolds have been the subject of energetic efforts at improvement by the many private seedsmen of the country.

Among mangolds, the Barres mangolds, of French origin, have been most successfully improved as to uniformity, yield and production of dry matter. The method adopted, which, with the exception of slight modifications according to the species, is the same for all root crops, may be briefly described as follows:

The selection of the seed mangolds is made from the common stock. The finest mangolds are selected in large numbers and, with the object of provisional selection, often submitted to a direct test as to specific gravity, using a solution of salt of suitable strength. The heaviest mangolds are selected and with each of them the specific gravity of the juice is determined by means of an areometer. Some of the best breeders proceed further to the direct determination of the dry matter of the individual mangolds in samples bored out of the roots, and then set aside separately the most promising specimens. These are then enclosed, either singly or in pairs, in linen cloth bags until the flowering time is over. The seeds of the individual mangolds are sown in one or more small plots. The process is repeated with the offspring of the best lines.

Among the mangolds thus improved, those that deserve to be mentioned as the best are the Sludstrup, Rosted and Taaröje varieties, which have proved in the course of extensive experiments instituted by the State to be far superior to all foreign varieties in the production of dry matter per unit area. Similar results have been obtained with kohlrabi, turnips and carrots.

The exhaustive experiments carried out in the State Experiment Stations with the object of determining the value of the various root crops are placed under the management of L. HELWEG, of Copenhagen, director of the experiments. These experiments are of decisive importance both for the improvers and for the farmers, who would otherwise be seriously embarassed in the choice of the variety to grow. If the experiments were not conducted as they are, advertisements would be the only guide, while these experiments provide a decisive and impartial verdict on the results of the work of improvement. At intervals of a few years the results obtained in the State experiments are published in the "Tidsskrift før Landbrugets Planteavl" (Journal of Agricultural Plant Breeding), which appears in four parts every year, and discusses all the results of the experimental work of the State in Denmark.

Cereals. — As has been said above, but little was accomplished in this field previous to the year 1899-1900. At any rate, with the exception of Erhard Frederiksen's work, the results of practical importance have been obtained after that date. The work then began to proceed much more rapidly, partly owing to the new and more promising principles of plant improvement. Especially the discovery of breeding in lines attracted more breeders into the field. The first results of Svalöf in Sweden and the work of the Danish Professor JOHANNSEN, which proved that the type remained unchanged generation after generation in the individual lines of autogamous plants, contributed to awaken hopes which in reality did not lead to disappointment.

Up to the year 1899-1900 almost all breeders practised mass selection, that is selection of promising individuals or ears followed by breeding mixtures of this so-called " Elite ". The demand for this Elite was gradually raised, but on the whole the practical results were not great, and often even negative. Attention was continually directed too much to the *individuals* instead of to their *offspring*. It happened and still happens that the largest and apparently strongest plants by no means give the best offspring; on the contrary the more modest-looking plants often produce the best progeny. In this connexion there could be no clear understanding so long as the *importance of heredity was not duly recognized*. In a mixture the more modest forms are often — literally as well as metaphorically — overshadowed by the finest individuals; the latter however, in pure cultures, prove often inferior to the pure cultures of the progeny of less handsome individuals.

For a long time after the cultivation of the offspring of single individuals had been begun, it was rather difficult to understand the matter fully, notwithstanding the fact that striking proofs could be afforded that it was the right method to pursue. A critical examination of those varieties which, in the course of years, had been tried and then abandoned in favour of more productive ones, showed that as a rule the less good looking varieties were the best. The most esteemed about 1900 were: Squarehead wheat, Brattingborg rye, Danish (Provsti) oats and Prentice barley. All these varieties were, after the exhaustive experiments undertaken by P. Nielsen and, later, by the Malting Barley and Wheat Committee, recognised as the best for Danish conditions; yet none of them could compete in appearance in the field, and on a rapid valuation of superficial conditions of growth, with a whole series of varieties which in reality were inferior in yield and quality. In one or more points the latter failed to meet the demands which are made in this country as to resistance to cold, strength of haulm, resistance to diseases of various kinds and yield of grain. The latter property depends upon so many factors that there are always but few varieties that possess the fortunate combination of all these privileges to any high degree.

About the year 1900 the following breeders were at work (partly on the above-mentioned lines of individual plants and their offspring): K. HANSEN, Lyngby Experiment Station; K. JØRGENSEN, Lyngby; N. P. NIELSEN, Tystofte; H. A. B. VESTERGAARD, Naesgaard (later Abed). The three latter worked almost exclusively with "pure lines". The first results of these labours appeared in the years 1906-08 in a series of varieties of oats, barley and wheat (winter wheat). The following showed themselves, in numerous experiments, decidedly superior to the older varieties. Tystofte Prentice barley, Abed Prentice barley, Yellow-white Tystofte oats, Yellow Näsgaard oats, Tystofte Small wheat, Tystofte Stand-up wheat and Abed Large-eared wheat. The barleys are two-rowed and bent-eared. From six-rowed barley, Tystofte Hybrid barley has been bred.

Within the next few years several varieties will appear, among others Abed Binder barley.

At Lyngby some new varieties of winter barleys have lately been produced. In rye no novelties have been developed. The above-mentioned Brattinborg rye and the well-known German Petkus rye are generallly grown, and it will probably be some years before any new Danish-bred ryes appear.

The method adopted will be briefly described. The foundation is in all the above cases the individual plant. In its details the method varies: first the variety is selected from which a line is to be bred; this is frequently one of the so-called country varieties, which includes several individual types. We can assume that a hundred such have been chosen; the next year fifty grains from each are laid, grain by grain, in furrows or holes in parallel lines; the growing plants are observed and all their various properties which can be of importance in practice are described. Each line is harvested by itself; the quantities of grain and of straw are examined, and the thirty most promising lines are used for experiments plots on a small scale in the following year. The plots are two, each of 4 or 5 square yards in extent. In this year also the young plants are carefully observed in the field; those with the weakest straw, as well as those inclined to disease, are eliminated. Only the eight or ten that yield the best results are kept for further experiments. The experiment in the third year are more comprehensive and are undertaken in a way to ensure greater reliance upon the results, for three or four parallel experiments are made on plots measuring 12 or 24 square yards. If all conditions have been favourable, the result of this experiment can be used for the further elimination of the least valuable novelties, and only two or three varieties are kept. The experiment is continued in the fourth year as in the third, and if no untoward circumstance arises according to the result of this year, in the fifth year the multiplication of the most productive variety on a large scale in the fields can be contemplated. But it seldom happens that one can foresee with sufficient certainty that the selected variety is really so much better than the best hitherto known, and in order to ascertain this, still a few more years must be devoted to experiments. For this experiment a good opportunity is offered by the two years which are generally required to bring the small quantity from the experiment plot to saleable quantities. In Denmark the State contributes also to the final decision of the question whether the new variety deserves to be put into general use or not, inasmuch as every variety of importance is tried in the Experiment Stations.

There is, besides, the local travelling experimental work conducted by the individual agricultural organizations. The experiments are undertaken by farmers under its supervision, so that the varieties are brought under varying conditions, and in every case they are compared with the best varieties of the same kind known at the time. When a new variety has satisfactorily stood these tests, as a rule it soon gets the rapid diffusion that it deserves, since the farmers are often acquainted with the results of the experiments before the variety is put upon the market. The offers of sale are made either by the State or by the agricultural organizations.

In the Experiment Stations where many varieties are compared, 6

to 8 plots are used for every variety. In local experiments with only two or three varieties 10 or 12 plots are used so as to ensure reliable results.

The publication of the results of the travelling experiments is made once a year in the written (and verbal) reports of the Agricultural Federations in each of the four parts of the country: Jutland, Fünen, Seeland and Lolland-Falster.

The reports of the State Experiment Stations appear at longer intervals, embracing from 4 to 8 years. The results are thus based on the experiments of several years. Thus the two kinds of experimental work complete each other, in this as in many other fields, for the solution of the various questions.

The Chairman of the State Plant Breeding Committee is Professor T. WESTERMANN of Copenhagen.

Some of the recent results obtained in the State Experiment Stations with varieties and breeds of agricultural plants are mentioned below, as they present a more than local interest.

Experiments were made with *wheats* at Tystofte and Abed from 1907 to 1912. The greatest yields were given throughout by Wilhelmina Small wheat, Stand-up wheat and Large-eared wheat, which yielded from 58 to 67 bushels per acre. The three latter are Danish varieties of recent origin; all of them, but especially the Stand-up wheat, are more resistant to cold than Wilhelmina. Altogether 20 varieties were tested, including 4 from Svalöf, 2 from Germany (Strube's Stockweizen No. 56 and Strube's Squarehead) and 2 from England (Stand-up and Original Squarehead). The worst yielding varieties gave, under the same conditions as the above-mentioned ones, 35 to 49 bushels per acre.

With *oats*, experiments have been conducted during a small number of years at six Experiment Stations. Out of 15 varieties tested, the following yielded the best results, with 84 to 87 bushels (of 42 lbs.) per acre: Yellow Näsgaard, Stern, Schlanstedt and Yellow-white Tystofte. The two first gave the best results on both loamy and sandy soil. Among the less productive were the following well-known varieties: Ligowo, Goldregen and Leutewitz. With the exception of Schlanstedt, the first group are all of Danish origin. The varieties that yielded least gave 8 to 12 bushels per acre less than the best.

Before the new varieties appeared, a great number of foreign varieties were tested, but all of them, with the exception of Schlanstedt and American Banner oats, yielded light crops.

With *barley* both the Agricultural Associations and the State Stations have conducted experiments for a series of years. The most productive varieties were Tystofte Prentice, Abed Prentice and Svalöf Princess. All these varieties sprang from the Prentice barley introduced in 1884, which, as was known later, was called Archer barley in its home (? Ireland). Of the other varieties grown, the following are to be mentioned: Svalöf Hannchen, Hanna, Goldthorpe, Imperial, Juwel, Stand-well, Chevalier. None of these, however, could compete throughout with pure-bred Prentice forms. The chief defects of Prentice barley are that it ripens late and

that the strength of the straw leaves something to the desired. Of late years all efforts have been directed towards producing an earlier variety with stronger straw.

Abed Binder barley appears, anyhow, to possess these last two requisites, but has not yet been tested enough under various conditions as to its productiveness. The variety is therefore not yet sent out for practical purposes.

Grasses and clovers. — Work with these, as with cereals, is comparatively recent and the nature of the work is such that it takes longer to reach decisive results with these plants than with the annual cereals. There is also the circumstance that most of them are allogamous, which renders constancy more difficult or impossible to attain.

The Experiment Station at Tystofte, whose Director is E. LINDHARD, deals especially with the improvement of these plants. A new improved ryegrass has been sent out this year from Tystofte. At Lyngby and Abed also, work is conducted on some kinds of forage plants.

The work at Tystofte is very extensive, especial attention being paid to isolating the individual forms, as well as to reliable control with the parent form in order to obtain the greatest possible constancy. Many hundreds of plants are enclosed in bags and harvested separately. The multiplication of elite plants is practised on a large scale. In order to ensure the pollination of red clover, nests of humble bees are enclosed with the clover elite in large linen tents. In this direction a great deal of work is done, but it will require five or six years more before judgment can be pronounced on the results.

The Cultivation of Sugar Cane in the Argentine Republic

by

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Director of the National School of Agriculture and of Sugar-making at Tucuman, Argentina.

Historical notice. — Among the industrial plants grown in the Argentine Republic only two have acquired much importance : the vine and the sugar cane.

The latter was introduced into America by the Spaniards shortly after the conquest, and it spread immediately into the West Indies, Central America, Peru, Brazil and the northern part of Argentina. The first trustworthy evidence of the cultivation of sugar cane in this country dates back to the beginning of the seventeenth century and refers, as it appears from the archives, to a plantation which existed in the district of Chicligasta, province of Tucuman. However, before the Jesuits established themselves in this province in 1670 and founded a convent which still exists at Sules, no one had manufactured sugar in the country and the canes were only used for sucking.

In 1767 the Jesuits were expelled from Argentina, the manufacture of sugar ceased and the cultivation of sugar cane was kept up only on very limited areas. Up to the middle of the nineteenth century all the sugar consumed in the Argentine Republic came from abroad. For 54 years after the expulsion of the Jesuits, no one, as far as is known, made sugar, no doubt because no one was acquainted with the industrial treatment of the cane. In 1821 Dr. José Eusebio Colombres, a Tucuman priest who also played an important part in the political organization of the Republic, made a successful attempt to restart the sugar cane industry. At first only molasses were made. The results obtained by Dr. Colombres induced others to follow his example, and gradually rudimentary factories sprang up, at first satisfying the demands of the Tucuman market and later those of the neighbouring provinces.

It will easily be understood that as Tucuman is upwards of 600 miles from the nearest port, the first factories were very primitive, and that the sugar they produced did not reach the distant coast district, which at that time was the most populated and almost the only one having a civilized population that consumed sugar. In 1834, notwithstanding the short time that had elapsed since Dr. Colombres' initiative, the local Government dared to impose a tax of one peso per arroba (about 2 pence per lb). A few years later 24 small factories were at work. In 1860, without any other means of transporting heavy modern machinery than the traditional Tucuman bullock-cart, a bold attempt at improvement was made, which proved economically disastrous to its originator, Balthasar Aguirre, but must be mentioned because it had an influence on the subsequent improvement of the sugar industry.

Area under sugar cane. — The national statistics of 1911 return the area under sugar cane in the whole Republic at 230 770 acres, of which 210 000 are in the province of Tucuman; it must not be forgotten, however, that Argentine statistics cannot be very exact, as the country is not yet fully organized and of enormous extent, and its institutions are still, in some respects, rudimentary. The general statistics to the end of 1913 are not yet published. The provincial statistics recently completed show that the province of Tucuman alone had on January 1, 1913, 220 000 acres under sugar cane.

As the cane plantations in the other provinces and territories extend very slowly, the acreage grown to canes in the whole Republic may be safely estimated at 250 000 acres.

The above data on the cultivation and on the utilization of the sugar cane refer almost exclusively to the province of Tucuman, which, as it is a very important economic and social centre, is destined to keep for many years its present supremacy in this industry, notwithstanding the existenc of other districts in Argentina equally and perhaps even more suitable for this crop.

Soil. — As sugar cane is grown over a wide area it occupies soils of different kinds; they may be divided into two groups:

a) Loams, which contain up to 90 per cent. of clay, most of it being very fine. In general, growing sugar cane on such soils is not possible without the aid of irrigation.

b) Humous sands which have been recently cleared of forests and are situated on the slopes of forest-clad mountains, and where the cane can be grown without irrigation, as the soil is fairly moist, especially where it has been under cultivation for only a few years.

The chemical composition of most of the soils does not vary much: there is scarcity of lime, which rarely reaches 1 per cent., and an abundance of potash, of which these soils contain from 4 to 6 per 1000; they have a normal quantity of phosphoric acid, that is upwards of 1 per 1000, and of nitrogen, also about 1 per 1000.

Owing to the relatively recent introduction of this plant, to the depth of the arable layer and to economical reasons, the use of artificials has not yet become general.

Climate. — In the district of the province of Tucuman in which sugar cane is grown, and which lies between the parallels of 26° and 28° S, the climate is subtropical, but tempered by the vicinity of the high range of Aconquija on the west. These mountains are at the same time the principal cause of the rain which benefits local agriculture, rendering Tucuman a region of abundant moisture surrounded by completely arid belts in which no rain falls.

Meteorological observations carried on for many years exist only for the city of Tucuman, to which the data here given refer. They are therefore not strictly accurate for all the sugar cane area. The average rainfall of the last decade was 965 mm. (37.98 inches); the maximum during this period was 1308.3 mm. (51.51 in.), the minimum 739 mm. (29.09 in.). At the foot of the mountains, where most of the non-irrigated cane-fields are situated, the rainfall is considerably higher than the above average. The average mean temperature of 45 years is 19.28° C. (66.7° F.), the average highest 44.4° C. (112° F.), the average lowest 3.2° C. (37.8° F.). In the last decade 90 temperature readings were below 0° C. (32° F.) in the months of June to August, chiefly in June; and 6 readings above 40° C. (104° F.) in November, December and February. The influence of the wind on the temperature is great; south-easterly winds lower it by 1.9° C. (3.4° F.), northerly winds by 2.4° C. (4.3° F.); southerly winds raise the temperature by 1.8° C. (3.2° F.), while those from the west lower it by the same amount. The winds are moderate and not frequent, and therefore do not cause lodging of the canes.

Varieties. — The greater portion of the area is under two varieties of cane which were introduced many years ago: the brown *Morada* variety, which is the prevailing one, and the striped or *Rayada*, next in importance. Both are considered local varieties (*criollas*), because they have acquired special characters which do not allow the original variety from which they are derived to be recognized.

For some years past attention has been turned to the cultivation of varieties introduced from other countries. The initiative of these experiments, at present in full swing, belongs to the "Escuela Nacional de Agricul-

tura y Sacarotécnia" of Tucuman, which in 1907 introduced 70 varieties. At present this institute possesses a collection of upwards of 250 groups of varieties, many of which have been studied from a technical point of view during the last few years. Though at present insufficient experience has been gained in this connection, it may be affirmed that the research hitherto carried out leads to the belief that, as in other countries, it will soon be found advantageous to replace to a great extent, if not totally, the varieties hitherto grown by some of those recently tly introduced. It is beyond discussion that the initiative of the Escuela de Agricultura y Sacarotécnia has raised much interest among the planters, many of whom have already provided themselves with the new seeds in order to test them, and thus cooperate efficiently with the official work.

The cultivation of sugar cane in the Argentine Republic will soon cease to be based only on colonial practice and tradition, and will be founded, as it is in other countries, on a scientific basis which will ensure an increased and an improved production of sugar.

As it is not possible to set forth in detail all the experiments that have been hitherto carried out, we shall limit ourselves to a summary of the experiments conducted in 1913 on some varieties of cane at the Agricultural Station attached to the Escuela Nacional de Agricultura y Sacarotécnia.

Form and duration of the plantations. — In the Argentine cane fields only one system of planting is followed: in the bottom of the furrow 8 or 10 inches deep the cane cuttings, each with three or four eyes, are placed in a continuous series. The rows are 6ft to 6ft. 8 in. apart The plantation is renewed every 6 or 7 years according to the quality of the soil. There are, however, plantations in which the canes are harvested without interruption for 10,12 and even 15 years. The first year after planting, the canes always give a crop inferior in quality and in quantity to that obtained from the canes originating from ratoons, the explanation being the shorter period of vegetation of the former. Plantations made in September or October are cropped in June or July of the following year, that is at 9 or 10 months old.

Irrigation. — Barely one-third of the acreage under canes in Tucuman is artificially irrigated. Owing to the abundance of rain from October to April, the canes, even without irrigation, yield remunerative crops under existing economic conditions. It is undeniable that in many cases the yield could be increased by means of irrigation, but for this it would be necessary to carry out important irrigation works, some of which have been planned during recent years. But even in the localities where irrigation water is available it is quite exceptional to find estates which irrigate systematically and drain in a suitable manner; thus it is not rare to find irrigation more injurious than benefical. The time in which irrigation is practised is from October to February.

The work of cultivating does not last more than 6 or 7 months. The law on irrigation at present in vigour allows 25.7 cub. feet of water per acre per hour permanently, without taking into consideration the class of

crop. But only rarely is this quantity actually obtained, as the canals do not convey the necessary supplies.

Form of agricultural agreement for the cultivation of sugar cane. — In Argentina the sugar cane is grown under three forms of labour contract: 1) the plantations are managed directly by the owner himself or by an agent with the help of hired labour; 2) they are worked on the share system by a "contratista"; 3) they are rented. The first is the least frequent, as there are but few large proprietors who reside on their estates and manage them personally. This form, however, yields the largest profits, one acre of cane plantation yielding as much as £7 to £10 per annum.

The contratista gets by contract a certain number of rows of canes each 330 feet long; the sugar factory or the owner of the plantation supplies him, at a rate of interest agreed upon, with the necessary funds for all the farming operations, and at harvest time purchases the canes from him at a price which has been previously agreed upon between the parties, or which is fixed from year to year upon the basis of the current prices of sugar. The usual price is from 12*s* 3*d* to 14*s* per ton of cane delivered at the sugar factory; assuming the produce to be about 10 tons per acre, which is an average yield, the grower gets £1 15*s* to £2 10*s* per acre net profit. Of course in bad years his profits are much less. This is the most common agreement, and usually lasts 2 to 5 years.

Farmers who rent the land are very few; the rent is 4*s* 3*d* to 5*s* 8*d* per acre. The tenant plants and grows the canes on his own account, but almost always has a contract for the sale of the canes to a factory at a price proportional to that of the sugar.

Yield. — The old farmers of the province of Tucuman, who have grown cane for the last 20 or 30 years, maintain that the productivity of the striped and brown varieties has diminished considerably; almost all attribute this falling off to the exhaustion of the land, which has always been put to canes without manures or rotation. Though our observations during four consecutive years do not allow us to determine completely the cause of the diminished yield, this decrease is evident in many localities, if not in all.

In the Experimental Station attached in 1913 to the Escuela Nacional de Agricultura, a series of soil analyses has been undertaken, beginning with those soils which have been longest under this crop, and continuing with those on which it has been introduced later. Although the data hitherto collected are not complete, they point already to the fact that the decrease of production is not only due to the exhaustion of the soil, but also and mainly to lack of care in the selection of the cuttings employed for replanting the cane fields, as well as to imperfect cultivation.

Until lately, owing to mistaken economy, it was the general custom in making a plantation to use the tops, that is just that part of the cane in which the eyes are least developed. It is true that in other countries the tops are used for this purpose, but they are countries with a more tropical climate, in which the vegetation of the canes lasts as much as 20 months, whilst in Tucuman the canes are for the most part harvested after 10 to 14 months.

Besides, as the time of planting coincides with the dry season, the tops have a more difficult start. If to this be added that in all kinds of soil only superficial ploughing is practised, reaching at most to 8 inches in depth, it will be readily understood that the yield has diminished even without the soil being exhausted. Some owners are trying deep ploughing by means of steam ploughs with success.

The average yields per acre are at present as follows :

	tons
Bad years	6 ½ to 8
Normal years	9 to 10 ½
Good years	11 to 14
Very good years	16 to 20

The cost of production of one ton of canes is from 8*s* 9*d* to 12*s* 6*d*. The sale price varies from 19*s* 6*d* to 25*s*.

Causes of injuries to the canes. — In some years the canes suffer considerably from unfavourable weather, but so far they have no serious pests to contend with. Among vegetable parasites there is only "polvillo" (*Bacillus sacchari*), which attacks the leaves and arrests the development and ripening of the canes. The parasite does not always appear with the same intensity ; it attacks all the varieties cultivated in the province, but not with the same frequency or gravity.

Among insects, the borer or "perforador" (*Diatraea saccharalis*) causes considerable injury in those years favourable to its multiplication. Other insects which are at present being studied are also injurious, but the mischief they do is not very important.

Progress of the industry. — There are at present 38 sugar factories in Argentina, 28 of them being in the province of Tucuman and the others in the provinces of Salta, Jujuy and Santa Fé and in the national territories of the Chaco and Formosa.

The sugar industry has progressed more rapidly than the cultivation of the canes.The old and modest factories of past years, equipped with wooden presses worked by hand or gins, have disappeared before the modern factories, almost all of which are provided with up-to-date machinery and worked according to the most approved methods. Of late years triple pressing with double saturation and the use of the Krajewski mill have become general. For the evaporation of the liquids, triple and quadruple concentration apparatus is commonly used, as well as recrystallizers and continued defecation.

Owing to the improvement of the factories, the yield of the canes rose from 3 per cent. in 1870 to 5 per cent. in 1881, and to the following figures taken from the official statistical returns :

	Variety	Weight of canes per acre — lbs	Average weight of a cane — lbs	Number of canes per ton	Length — Average — inches	Length — Maximum — inches
4	Native Rayada	65 384	2.50	893	54	100
6	Native Morada	64 046	2.35	951	58	91
14	Poudre blanche	70 156	2.16	1 035	54	91
15	Roxa	57 757	2.13	1 049	52	85
18	Kavangire	94 362	1.39	1 604	69	104
19	Rayada from Brazil	47 900	1.55	1 445	50	79
26	Bois Rouge	55 482	2.04	1 093	46	87
36	D. Gaetano	68 327	3.86	573	71	108
46	Reine	57 712	2.10	1 066	47	87
48	Rose cayana	56 594	2.74	816	52	97
50	Green from the Antilles	53 921	2.40	931	55	98
55	Sin nombre 55	54 100	2.38	939	62	100
58	» » 58	59 095	2.20	1 014	58	93
62	» » 62	43 084	1.96	1 141	54	83
64	» » 64	71 583	3.48	643	65	104
74	Riscada de Santa Barbara	59 496	2.82	792	63	98
75	Manteiga de Santa Barbara	76 489	3.52	634	67	106
76	Java 234, ratoons	49 238	1.74	1 284	65	106
77	Sin nombre 77	114 622	1.32	1 691	69	108
79	Java 228, plant canes	64 090	2.10	1 066	57	91
	» ratoons	69 576	—	—	—	—
80	» 139 plant canes	48 123	1.58	1 418	60	93
	» ratoons	45 893	—	—	—	—
81	» 38 plant canes	81 350	2.45	912	72	104
	» ratoons	108 021	—	—	—	—
82	» 213 plant canes	56 241	1.58	1 411	47	93
	» ratoons	92 723	—	—	—	—
83	Barbara 228 plant canes	34 208	2.21	1 013	35	79

Diameter			Extraction	Analysis of juice					Saccharose extracted from 100 lbs of cane	Saccharose extracted per acre	Comparative value of cane	Classification according to comparative value
Average — inches	Maximum — inches	Minimum — inches		Brix %	Saccharose %	Purity	Reduction %	Reduction % saccharose	— lbs	— lbs		
1.30	1.93	0.63	65.1	16.44	14.08	85.6	0.31	2.2	9.152	5 984	61.2	11
1.20	1.81	0.55	62.8	17.61	15.42	87.5	0.21	1.3	9.684	6 202	64.8	9
1.16	1.54	0.75	63.0	17.10	14.38	84.1	0.64	4.4	9.059	6 356	63.8	10
1.19	1.54	0.79	61.4	16.22	13.58	83.7	0.53	3.9	8.338	4 816	48.1	20
0.79	1.14	0.43	60.3	16.68	13.60	81.5	0.28	2.0	8.241	8 024	78.1	5
1.03	1.42	0.67	61.2	14.63	11.35	77.6	0.28	2.4	6.945	3 327	30.8	28
1.20	1.58	0.83	62.3	16.67	14.18	85.0	0.35	2.4	8.834	4 902	49.8	19
1.38	1.81	0.87	67.9	17.39	14.80	85.1	0.55	3.7	10.049	6 866	69.8	7
1.23	1.58	0.79	61.5	16.63	14.41	86.5	0.30	2.1	8.662	5 115	53.0	16
1.36	1.85	0.79	64.0	16.10	14.15	87.8	0.30	2.1	9.055	5 125	53.7	14
1.22	1.58	0.87	63.3	16.30	13.70	84.0	0.40	2.9	8.672	4 676	46.2	21
1.19	1.65	0.67	64.7	17.05	14.93	87.5	0.31	2.1	9.660	5 226	54.6	12
1.16	1.77	0.71	63.5	16.83	14.31	85.0	0.36	2.5	9.087	5 370	54.5	13
1.13	1.65	0.43	60.0	17.81	15.54	87.2	0.23	1.4	9.324	4 017	41.8	26
1.30	1.81	0.63	65.5	18.25	15.79	86.5	0.47	2.9	10.279	7 564	78.2	4
1.28	1.94	0.59	61.6	16.51	14.18	85.9	0.28	1.9	8.735	5 197	53.3	15
1.35	1.73	0.87	66.0	15.39	11.62	75.5	0.92	7.9	7.669	5 866	52.9	17
0.94	1.22	0.63	55.6	18.12	16.11	88.8	0.08	0.5	8.957	4 410	46.8	22
0.79	1.30	0.43	57.3	17.28	14.44	83.5	0.27	1.8	8.274	9 484	94.6	3
1.10	1.46	0.79	64.5	15.95	12.95	81.2	0.36	2.8	8.353	5 354	51.9	18
—	—	—	60.5	18.81	16.01	85.1	—	—	9.686	6 739	68.5	8
0.99	1.30	0.59	57.0	18.35	15.13	82.4	0.34	2.2	8.624	4 385	43.2	24
—	—	—	57.9	19.55	16.19	82.8	—	—	9.374	4 302	42.5	25
1.07	1.30	0.59	61.1	16.87	14.21	84.2	—	—	8.682	7 062	71.5	6
—	—	—	58.8	18.85	15.76	83.5	—	—	9.267	10 010	100.0	1
1.04	1.30	0.63	61.3	15.58	13.25	85.0	0.15	1.1	8.122	4 568	46.4	23
—	—	—	57.5	19.38	17.38	89.5	—	—	9.993	9 266	99.2	2
1.51	2.09	0.79	62.4	17.07	14.69	86.5	0.18	1.2	9.167	3 135	32.4	27

Years	%	Years	%
1903	7.56	1909	6.21
1904	8.07	1910	7.68
1905	7.49	1911	6.37
1906	6.14	1912	6.58
1907	6.52	1913 up to Oct. 31 .	8.03
1908	8.21		

In 1913 the most modern mills had an average yield above 9.5 per cent.

The further improvement of the methods of sugar-making will henceforward be assisted by the small sugar factory (capable of crushing 30 tons of canes per day) which, in June 1914, will begin to work at the Escuela Nacional de Agricultura y Sacarotécnia, and which is devoted to experiments, to objective teaching and to the instruction of capable experts.

Up to the present about £ 14 000 000 are invested in the sugar industry in the Argentine.

Foreign refined sugar pays at present a customs duty of $1^{3}/_{4}$ *d* per lb., which according to the provisions of law No. 8877 of February 8, 1912, will be gradually lowered to 1 ½ *d* per lb. in 1921.

At present only four sugar refineries exist in the Argentine; two of them are very important and others will soon be erected.

Recent Work of the Royal Hungarian Station of Biology and Animal Nutrition

by

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Of late years the Station has conducted research work of general interest connected mainly with the composition of the fodders produced in Hungary and their nutritive value, as well as upon animal metabolism, especially in pigs.

The Station has made exhaustive investigations into the problem of metabolism in these animals, on account of its theoretical and practical importance and also because it has been less studied than in cattle and horses. In order to reach reliable results, the metabolism in fasting pigs and the energy required for their maintenance must be known exactly.

With the aid of a respiratory apparatus, constructed for the purpose, the total quantity of water and of carbonic acid expired by the animal was determined; in the same way the animals under experiment could be observed at temperatures ranging from 5° C. to 30° C. The first research was to determine the minimum amount of energy required by the pig at rest and fasting. This amount depends in the first place upon the surrounding temperature and reaches its minimum at the so-called critical temperature,

at which the oxidation processes in the animal organism are at their lowest. Our experiments, made on two young pigs weighing 101.2 and 114.4 lbs., and two adult pigs weighing 250.8 and 279.4 lbs., have shown that, during fasting, the transformation of energy in the growing pig not fattened is lowest at a temperature of from 20° to 23° C. (68° to 73.4°F.), which is the critical temperature of the unfattened pig. In the fattening pig the critical temperature is probably lower, about 17° C. (62.6°F). The transformation of energy observed at the critical temperature is the minimum functional work of the pig, which, in the fattened animal (about 220 lbs.), is 8.91 calories per pound weight of the body and 98.5 calories per square foot of body-surface, while in the unfattened animal (about 110 lbs.) it is 12.36 calories per pound weight of the body and 102.2 calories per square foot of body surface. It follows that the minimum functional work calculated per unit of body-surface is independent of the fat in the animal.

Our recent experiments have the object of determining the requirements of energy in pigs.

We have recently experimented upon dried pomace, one of the fodders of the country. In Hungary the majority of distillers dry their pomace completely; only one distillery presses it before drying it, thus drying only its solid parts. We have compared these two kinds of pomace. Their composition varies very much, the variation being rendered more marked by the fact that the distilleries add carbonate of lime in varying quantities to the completely dry pomace. The pressed pomace contains less amides than the unpressed samples. In the latter the sum of fat and crude protein is generally between 39 and 44 per cent., and in the former between 44 and 60 per cent. The nutritive matters of pressed pomace are not so digestible as those of the entirely dried pomace, with the exception of protein, which is equally digestible in the two. The lower digestibility of pressed pomace is due to the elimination of the more digestible parts by pressing. It appears, by comparing the fresh and pressed pomace from the same source, that desiccation has no effect on the composition of the dry matter or on the properties of the fatty matter; on the other hand it diminishes considerably the digestibility of the crude and true protein. Dried pomace and, in a greater measure, fresh pomace caused a considerable fixing of nitrogen in cattle, that is to say they favoured the formation of flesh.

The experiments made with pomace assisted also in determining in what manner the dry and fresh material act on the production and composition of milk. Experiments made with two cows showed that the same quantity of dry matter fed either fresh or dry has the same effect on the quantity of milk, provided the requirements of the cows as to protein and energy be satisfied in both cases. When we fed fresh pomace in excess of the necessary food, only a very small part of the excess produced any noticeable effect on the animal organism and on the yield of milk. The substitution of dry pomace by fresh pomace containing the same quantity of dry matter did not in any way modify the content of dry matter and fat, or the specific gravity of the milk, or the index of refraction of the

milk serum. The substitution of fine wheat bran for dried pomace diminished the amount of milk yielded by the two cows under experiment. While the amount of fat in the milk of one cow did not change at all, in the other it increased a little.

The iodine number of the butter fat in the milk of the cow fed on wheat bran was lower than that of the one fed on dry or fresh maize pomace. After having been fed on fresh pomace, the iodine number of the butter fat was higher than when the animals consumed the same amount of dry matter under the form of pomace.

During recent years we have devoted much attention to maize for fodder, as this is one of the most important fodder plants of Hungary. It is generally sown in rows 6 to 8 inches apart; but for late sowing or in dry soils the distance between the rows is increased to 12 inches. This system is followed both for the maize to be fed green and for that to be ensilaged. For the latter, of late, distances of from 20 to 28 inches have been proposed.

In order to ascertain the influence of these distances between the rows on the yield and nutritive value of the fodder, we have determined the degree of digestibility, the yield of crude nutritive matter and the loss of weight caused by ensilage. The composition of maize sown close and wide varied considerably for a number of samples of green and ensilaged maize grown in both ways; the crude fat and protein content of the crop sown close was inferior to that of the other according to comparative feeding experiments on sheep; the digestibility of the maize after being ensilaged was the same in the two cases. The production of crude nutritive matter varies exclusively with climatic conditions, for after a normal amount of rainfall it is the closely sown maize that yields most, while after a dry summer the reverse is the case. Nevertheless this difference is not proportional to the greater expense of sowing maize in drills wide apart.

Considering: 1) that the later harvest of maize sown in drills wide apart delays ploughing operations considerably; 2) that it is more expensive than close sowing; 3) that it is only in dry years that the greater cost is balanced by the heavier yield, it may be concluded that wide sowing is only justified where drought is frequent.

Our Station has also determined the losses caused by the fermentation of other important fodder plants, such as lucerne, beets (tops and leaves) and the stalks of common maize. We have recently made similar experiments on mangolds, and then by experiments on pigs we have determined the percentage of nutritive digestible matter in fresh and in ensilaged mangolds.

The digestibility of ensilaged mangolds was somewhat inferior to that of the fresh mangolds. The coefficient of digestibility of the ash and of the crude protein showed great divergence. On the total organic matter preserved in the silo there was a loss of 13.1 per cent., and on the total digestible organic matter it was 14.6 per cent. The greater part of the absolute loss was in the carbohydrates, which make up the bulk of the organic matter of the mangolds, whilst it was the digestible protein which suffered

the greatest relative loss (30.93 per cent.). As, however, the protein content of mangolds is very low, this loss deos not diminish the favourable results of ensilaging. Besides, this result could be attributed not only to the quality of the mangolds but also to the duration of storage in the silo, which was 3 ½ months.

Considering that in Hungary the tops and leaves of beets are much used as food for cows, we have determined the digestibility of this forage both fresh and ensilaged, investigating also its influence on the production and composition of the milk. As the farmers who dispose of the tops and leaves of beets generally also get the pulp of the beets from the sugar factories we have compared these two fodders. These experiments, carried out on two farms, were made on 66 cows. They have demonstrated that feeding the same quantity of wilted tops and leaves and acid pulp instead of fresh pulp increased the milk yield and the live weight of the cows, while the specific gravity and butterfat of the milk did not undergo any variation. By feeding tops and leaves of beets in sour ensilage instead of an equal quantity of sweet pulp, the milk yield, the live weight of the cows, and the specific gravity and butterfat of the milk did not show any variation.

The chemical and physical properties of the butterfat produced by feeding wilted tops and leaves in sour ensilage did not differ at all from those of the butterfat of the milk obtained by feeding with beet pulp, which is important from the point of view of the manufacture of butter.

The milk of cows fed on beet pulp and tops and leaves, wilted or as sour ensilage, coagulated with the same rapidity and presented no difference in the composition of the curd, so that cheese of the same flavour and composition can be made from the two milks.

Experiments and Points of View in the Study of Animal Metabolism with the aid of the Respiratory Apparatus

by

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The scientific study of the nutrition of domestic animals was limited for a long time to the analyses of foods and to their comparison with the excretions, from which the material used in the body of the animal was inferred. Though the analyses of food, connected with the analysis of the solid excrements and of the urine, rendered possible the determination of the *digestibility* of foods and of the proportion of proteins retained by the body, and, in comparison with the simple analyses of foods, represented a considerable step forward, still simple practical observation showed that equal quantities of digestible foods by no means always

caused the same performance on the part of the animals, in the form of either work or human food (milk, meat, fat). On these conditions of uncertainty only the use of the respiratory apparatus could throw light, because it allowed the consumption and the retention of the nitrogen-free components of the food and of the animal body to be determined with the same precision as was formerly possible only for the nitrogen-containing substances by means of the analysis of the urine. The method of keeping account of animal metabolism by determinations made on excreta contemporaneously with those on the respiratory function, according to Pettenkofer's method, was first applied to the larger domestic animals by Growen, then in a considerably improved form by Henneberg and Stohmann; finally, it became so accurate in the hands of Gustav Kühn and especially of Kellner that it afforded the possibility of obtaining data on the effect of the most important foods in the animal body.

The simplest conditions are those offered by the Carnivora, in which the food contains very little inert matter, so that the greater part of it is digested and utilized in the body of the animal. Consequently it was with Carnivora that Bidder and Schmidt, Bischoff, Voit and Rubner were able to establish the first precise laws on the relation between the matter taken into the body and that retained by it. A schema of the processes involved, which, though not true under all conditions, is very suitable as a basis for further considerations, is afforded by the substitution, demonstrated by Rubner for certain cases, of the transformed component parts of the body and of the foods in proportion to their combustion heat. Rubner called isodynamic those quantities of different foods which have the same effect in the body in keeping up its composition, and found that such quantities of food as, on being burned, produced the same amount of heat proved isodynamic.

This view harmonizes with the experience which I had already acquired with Von Mering on the quantity of oxygen which animals take up with various foods. We found that the consumption of oxygen of an animal is not noticeably altered when foods which previously did not exist in large quantities in its body are introduced directly into the blood; this was shown with sugar, organic acids, certain soluble proteids, and the products of their splitting up. The amount of heat produced by combustion with a definite amount of oxygen is almost the same for all foods; for proteids and fats it is almost equal, while for carbohydrates it is about 5 per cent. higher. Consequently we also found that on supplying some of the latter, sugar for instance, the consumption of oxygen sank somewhat when the animal had previously performed its work, as is the case in a state of hunger, at the expense of the fat of its body. The reciprocal substitution of foods in relation to the heat produced in the body by their transformation appears most clearly in the case of muscular work. For a certain mechanical work the organism, as, in conjunction with several collaborators, I was able to prove by means of respiratory experiments, always requires the same energy expressed in

calories, and this independently of whether it be produced by transformation of carbohydrates, fat or protein.

The isodynamism of foodstuffs with those constituents of the body that are burned under conditions of hunger does not exist when the former are fed in greater quantities. An increase of consumption takes place, which is very probably caused by the active work of the alimentary canal, and its muscles and glands, as well as by the increased action of the heart, the kidneys and other organs, caused by elaborating the food. This view of considering the greater consumption after giving food as "work of digestion" is supported especially by the behaviour of herbivorous animals, which take a quantity of inert matter in their food. In the horse we were able to prove that an increase of the transformation much superior to that due to the digestible nutriment takes place under the action of the crude fibre of plant food, and to such a degree that every gram of crude fibre in the forage, which by its combustion would produce 4.2 calories, requires 2.6 of these for the increase of the transformation that it renders necessary, that is for the greater work of digesting. A considerable portion of this work of digestion we were able to attribute, in the horse, to the work of mastication, for during the mastication and swallowing of food rich in crude fibre an increase of consumption takes place; for hay this amounts to about 10 per cent. of the total combustion value of this food. Kellner has proved in the case of cattle fed with straw that the consumption is much diminished when the food is given finely ground or when it is freed from its encrusting matter by the process adopted in paper making.

For these investigations, as well as for those on the effect of working the animals upon metabolism, a method of carrying out respiratory experiments which Geppert and I have elaborated, and which differs considerably from Pettenkofer's, has proved the most suitable. We examined directly the air exhaled, either by a fistula in the wind-pipe or, in the case of men, by suitable masks which prevented all losses. This method (1) is superior to Pettenkofer's in that we could analyse with the same precision not only the carbonic acid given off, but also the consumption of oxygen, and measure exactly the combustion processes in the animal body for short periods, even for only a few minutes. We were thus able to ascertain precisely the effect of *every kind of muscular work* in man and in animals and also the effect which the *food exerts in the various stages of digestion.*

Not less important than the possibility afforded by our method of carrying out analyses during any short space of time, is the fact that we can ascertain at the same time and with equal precision, the consumption of oxygen and the production of carbonic acid. Only in this way is it possible to become acquainted with the nature of the foods transformed in the body, for foods differ in their ratio of oxygen consumption to carbon dioxide production during combustion. This ratio, the so-called respiratory quotient, is especially different in fats and carbohydrates. The volume of carbonic acid produced divided by the oxygen consumed

(1) Cf. accurate description by MAGNUS LEVI, *Pflügers Arch.*, 55, p. 1.

gives 0.7 for the former and 1.00 for the latter. When, in feeding, fat is formed out of carbohydrates, the quotient rises above 1.00 and can with intense feeding attain the value of 1.34 (Bleibtren, with geese fattened on oatmeal cakes). When the carbohydrates of the food undergo fermentative processes in the digestive tract, in which hydrogen and methane are given off, the quotient of the total exchange of gases can also rise considerably over the unit. In these cases the determination of the production of carbonic acid alone is not sufficient to give an approximately exact idea of the transformation of energy in the body.

During the last few years we have gained in several directions a deeper insight into the processes of metabolism by means of a combination of our method for measuring the direct respiration of the lungs with an investigation of the 24 hours respiration processes in the closed chamber, in harmony with Pettenkofer's principle. In these long continued experiments, also, the great value of the simultaneous determination of the consumption of oxygen and of the production of carbonic acid has been recognized. The investigation into the transformations taking place in the animal body deals essentially with three classes of foods: proteins, fats and carbohydrates, which also differ considerably in the quantities of carbonic acid given off in the production of equal amounts of heat. If, as in the older metabolism investigations, we determine only the production of nitrogen and carbon (as carbon dioxide), we are only capable of ascertaining how much nitrogenous material, *i. e.* protein, has been transformed and how much carbon has been formed from nitrogen-free material (fat+carbohydrate). But if we want to know how much of each of these foods has been transformed, and this is necessary if we want to calculate the quantity of energy developed in the body under the form of heat, we must determine a third factor which allows us to distinguish between these two classes of nitrogen-free foods. This third factor can be either oxygen or the quantity of heat produced by the animal; the two factors are about equally suitable. For, with an equal production of carbonic acid, fat produces about 24 per cent. more heat than carbohydrates and requires about 41 per cent. more oxygen. The choice of methods thus depends chiefly upon the relative facility and reliability of measuring the heat on the one hand, or the consumption of oxygen on the other. In the present state of technical knowledge, the determination of the oxygen, especially for short periods, is the more exact method. The best is to determine both factors, as has been practised by Benedict and his collaborators in recent experiments. In the generation of heat we have, then, a very valuable control of the results calculated from the production of nitrogen and carbonic acid and the absorption of oxygen.

The method developed by me for the determination of the consumption of oxygen in experiments lasting any length of time, is only an improvement on the respiratory apparatus used for small animals by Regnault and Reiset, before Pettenkofer.

The disadvantage of this apparatus was that the carbonic acid content in the air of the box was abnormally high, and that it was also permanently saturated with aqueous vapour, besides which the odorous emanations from the alimentary canal accumulated in it in increasing quantities. The way in which all these inconveniences have been avoided in my apparatus is described in detail in Vol. 44 of the *Landwirtschaftliche Jahrbücher*. I only mention that it is possible to determine with it the consumption of oxygen, the development of carbonic acid, and also, if desired, the evaporation of water from the animal body, with equal precision, and that during the whole time the air of the chamber can be kept dry and free from odours. In another direction also, which is especially important in research work on ruminants and on pigs, I was able to improve on Pettenkofer's method by providing greater precision for the determination of the combustible gases. Among these, methane is produced by ruminants in such quantities that it accounts for about 10 per cent. of all the carbon emitted under the form of gas, as was determined first in the experiments of Pettenkofer, and later confirmed by Kühn and Kellner. The method of Regnault-Reiset as used by us has the advantage that these gases remain entirely in the respiratory chamber up to the end of the experiment, and that therefore their percentage in the air to be analysed is much higher and can consequently be determined with greater precision. We succeeded also in estimating exactly the amount of hydrogen formed. This is often produced together with methane in the intestinal fermentations, and is important in some experiments, for instance in those after feeding large quantities of foods containing sugar. Up to one-fifth of the combustible gases consisted of the hitherto neglected hydrogen, and the proportion of this gas is still greater in the intestinal fermentations in pigs. Even a considerable accumulation of hydrogen and methane in the air of the respiratory chamber are of no consequence, as neither of the gases is poisonous and they have no more effect than the nitrogen of the atmosphere.

We have already mentioned that the nutritive value of a food is considerably modified by the amount of energy which is lost in its digestion and assimilation. It must be added that, with many foods, there are notable losses in the later transformations undergone in the body (specific dynamic effect according to Rubner), and that these losses play an important part with proteins. To these two causes of disagreement between the heat produced by combustion of the food and its nutritive value in the body, a third cause, especially active in ruminants, may be added, *viz.* the loss of energy through fermentation. Kellner attempted its determination and made allowances for it in his experiments by determining the combustible gases developed. It is, however, clear that the combustible gases make up only a part of the loss. We know that every fermentation which is a vital process of lower organisms is connected with the consumption of energy: we observe an instance of this consumption of energy in the heat given off in the fermentation of yeast. Such "fermentation heat", produced in the fermentations in the intestine, can only be of use to the animal in

those rare cases in which the heat produced by metabolism is not enough to cover its requirements. This happens with ruminants only when they find themselves in very cold surroundings in winter. Otherwise, the heat given off by fermentation processes, like that produced by fatiguing muscular work, must be got rid of by special work of the body, such as increased circulation of blood in the skin and secretion of perspiration, that is by consumption of energy.

From the above it is seen that the nutritive value of a food cannot be calculated simply from its content of digestible nutriment. From the quantity of energy that these digestible nutriments contain, the following have to be deducted : the work of digestion connected with their assimilation, the specific dynamical effect for their transformation into components of the body, and the losses by fermentation. From what has been previously said, it is evident that, among these factors, the work of digestion depends to an extraordinary degree upon the mechanical constitution of the food, upon its state of division, and upon its content of crude fibre. Similarly the loss by fermentation must be reckoned with, to a greater extent in ruminants, to a lesser one in other animals ; of this loss, hitherto we have only known a part, namely that represented by the combustible gases leaving the body, while the loss in fermentation heat has never yet been determined. As the fermentation processes vary considerably in extent in the various domestic animals, the utilization value of a food can only be given for a particular species of animal. Consequently the great number of determinations of the utilization value of foods, made by Kellner by means of Pettenkofer's respiratory apparatus, are true only for ruminants, or, to be still more precise, only for cattle, since in sheep it appears that the processes of fermentation are different. This fact must be borne in mind when using the "starch values" introduced by Kellner for convenience in calculating feeding rations. Under the term "starch value" of a food, he designates that quantity of a food which lays on as much fat as 1 kg. (2.2 lbs.) of starch.

In the horse, only a small proportion of the starch or of the starch-containing grain that is fed, ferments, while in cattle upwards of 10 per cent. of the heat of combustion of the digested food leaves the body unutilized as methane, besides which, another quantity of heat, which I provisionally estimate at about 70 per cent. of the heat of combustion of the methane, is lost as fermentation heat, while with fat no such loss occurs either in horses or in cattle. Consequently the ratio of the nutritive value of fat and starch is quite different in cattle and in horses. In pigs it is about the same as in horses. Thus if we apply to pigs or horses the same starch value for a fat food, such as an oil seed, as was determined by Kellner for cattle, we commit a notable error. But this is not the only uncertainty in these calculations. I may state that an important result of the investigations conducted of late years in my Institute has been to show that the same food may undergo very different losses by fermentation. According to the proportion in which a food is given, it ferments with greater or lesser intensity and suffers different losses. Of especial importance is the fact that

the fermentation of easily soluble sugars in the paunch of ruminants is from four to five times more rapid and intense than that of starch. Not less important is the fact that owing to the presence of such easily fermenting substances, the fermentation of cellulose, which is indispensable for the solution of the food, is considerably limited. Up to a certain point, the consequences of these irregularities in the fermentative processes have long been known. It is thus known that foods rich in sugar, especially beets, cause a so-called " depression of digestion ", that is, that they notably diminish the solution of cellulose and consequently act unfavourably on the total utilization of the food. What hitherto was not known, but which appears evident from our experiments, is the fact that even small changes in the composition of a food can have a great influence on its utilization. In corroboration I shall mention some experiments on the nutritive value of potato distiller's slop compared with the raw material from which it was made.

In collaboration with Von der Heide and Klein, I have published a report of these experiments in *Landwirtschaftliche Jahrbücher*, Vol. 44, p. 765. In four series of experiments a supplement was added to a basal ration of hay fairly sufficient to cover the requirements of the animal; it consisted in the second period of 5.5 lbs. of dried potatoes with the quantity of malt and yeast necessary for its fermentation. In the third period the supplement consisted of the slop produced by the same quantity of potatoes plus the amount of starch which had been lost by fermentation. In the fourth period the same quantity of energy which had been fed in the two previous periods was fed exclusively in the form of slop. The supplement was nearly equivalent, in respect of its combustion heat, for it corresponded:

in the	2nd	period	to a quantity	of heat	equal to	92.53	calories
»	3rd	»	»	»	»	92.37	»
»	4th	»	»	»	»	91.73	»

The fat and flesh laid on by the animal corresponded in the three periods to the following percentages of the combustion heat of the supplements:

2nd	period	47.8	per cent
3rd	»	33.78	»
4th	»	48.80	»

Of special significance is the comparison between the second and third periods, in which exactly the same food was given, except that in the third there were the modifications caused by the growth of the yeast and the formation of the bye-products of the transformation of starch into alcohol. The different effect of slop + starch mixture compared with the original material is shown almost more strikingly by the fact that in the second period 33 grams of protein were laid on daily by the animal, while in the third period 21 grams were lost, than by the combustion value of the material laid on.

The amount of fat laid on in the 2nd period was . . . . 446 grams
» » » 3rd » . . . . 341 »

If these experimental results are calculated according to Kellner's principle of the starch values of foods, it would appear from experiment 4 that the 2428 grams of slop fed, since they caused the laying on of 4477 calories, acted as 1897 grams of starch, which gives 100 parts by weight of dry slop 78.13 parts of starch value. This figure is about twice as high as the starch value which Kellner attributes to potato slop, without, however, basing it upon direct experiment. In opposition to this extremely favourable nutritive value of slop in the case of exclusive feeding together with hay, it shows itself much inferior in combination with starch. For the 1984 grams of crude starch containing water correspond to 1570 grams of pure starch, while the total material laid on, 3120 calories, corresponds to 1322 grams of starch value. In this case, then, the added slop had a negative value in its nutritive effect. The explanation lies exclusively in the enormous losses by fermentation caused by the combination of slop and starch. That the difference of fermentation, as it appears in the above example, was not due to change, could be proved by a further series of experiments by Markoft in which the fermentative processes were examined directly in the contents of the paunch extracted by means of the oesophageal tube (cf. *Biochem. Zeitschrift*, Vol. 34, p. 210, and Vol. 57, p. 1). The technical part of these experiments is fully described in the latter volume. It led to the proof that the addition of easily soluble carbohydrates, or the addition of soluble proteins or of amides, on a stomach content poor in protein, increases the fermentation to a considerable extent. But not only is the intensity of fermentation, *i. e.* the quantity of methane produced, deeply modified by changes in the composition of the contents of the paunch, but also the kind of fermentation, and consequently the magnitude of the losses. During the experiments, not only the quantities of the gases developed (CH_4 and H_2) were determined, but also the quantities of volatile fatty acids formed as fermentation products, which represent the utilizable products of fermentation. It was seen that for equal quantities of combustible gases, and for equal quantities of transformed carbohydrates, the quantity of fatty acids produced was very different, and consequently that the utilizable portion of the fermented carbohydrate varies very much according to the quality of the fermentation. In many cases, the common fermentation in which mainly butyric acid and methane are formed, is replaced by one in which the chief product is lactic acid with insignificant quantities of combustible gases. In this case the utilization of the fermented food is considerably more favourable than when methane is developed in great quantities, but cellulose appears to take but little or no part in this kind of fermentation. The cell membranes not being sufficiently opened, it leads therefore to a greater depression of digestion, which in the end makes it appear less favourable to the animal than the usual methane fermentation.

Further it has been observed during the above-described fermentation experiments, that fermentation can be very different when ensilaged forage,

such as ensilaged beet leaves or potato haulms is fed. Consequently all existing data on the nutritive value of such ensilaged foods must be revised. As is well known, hitherto, with all such kinds of foods, the loss of carbohydrates has been calculated under all circumstances as an equally large loss of nutritive material, whereas this view is not justified, because the organic acids formed in the course of fermentation are directly available to the animals, while most, if not all, of the carbohydrates fed in the fresh fodder ferment in the paunch forming the same acids. From the above it is evident that many parts of the hitherto accepted theory of feeding require revision.

We must no longer attribute to a certain food the same nutritive value under all circumstances, as has hitherto been done. We must rather find out in what combination the nutritive value of a food proves the most advantageous. We must learn to avoid the causes which depress digestion and the loss of nutritious matter by excessive fermentation, and, on the other hand, to choose such combinations of foods that the least easily digestible portions of the food are utilized to the greatest possible extent.

Hitherto we have been able to carry out only a few experiments in this new field of research. A series of experiments published in the *Landwirtschaftliche Versuchsstation* (Vol. 79-80) should be mentioned here, as it shows that one and the same food has a very different effect according to the way in which the various components of the same are mixed together. A food consisting of hay, starch, rye meal and linseed cake caused a greater formation of fat, and consequently a higher utilization value, when all the hay and the linseed cake were given at one feed, and the starch-containing foods at the other. In this case the stimulating effect of the concentrated food rich in albumen favoured the fermentations and the dissolution of the crude fibre of the hay, while in the check series of experiments in which the starch was given together with the hay, the crude fibre of the latter was digested to a smaller extent, so that the final result, namely the laying on of fat, was much less.

On the same principle as these experiments, the results of which have been published, other series of experiments have been carried out with the object of showing how the utilization value of a food is influenced by its special mechanical constitution and by the way in which the various components are mixed and set to ferment together in the paunch. In this way a series of experiments was carried out in which partially exhausted slices (Zuckerschnitzeln) were compared with completely exhausted slices to which molasses had been added to bring them up to the same sugar content as the others, the object being to ascertain how far the envelopment of the sugar by the cell membranes, which occurs in the partially exhausted slices, protects the sugar against losses by fermentation.

In other experiments molasses were given in various combinations with other foods. The effect on the fermentation when molasses was given as a drink was also tested; in this case it is not so intimately mixed with the rest of the food as it usually is when fed together with forage or concentrates. In yet another experiment molasses was mixed with

peat, as is frequently done in practice, in order to isolate it, to a certain degree, from the other foods in the paunch by means of this substance not liable to fermentation.

I anticipate important results from a series of experiments commenced during the summer in which the same forage was given dry and ensilaged. In valuing the nutritive value of ensilage, hitherto too decisive a part has been played by the simple analysis of the food, which showed that many carbohydrates were transformed into organic acids, thus causing heavy losses of combustibles gases. It has not been sufficiently considered that the fermentations in the silos proceed to a certain extent similarly to those in the paunch, and that possibly a part of the loss by fermentation in ensilaging is made good by a reduced fermentation in the alimentary canal of animals. This question is at present under investigation in the above experiment. At the same time it will be seen whether the presence in the paunch of material already fermenting is capable of altering the normal fermentation, and, under some circumstances, of increasing or of diminishing the losses by fermentation. It will be seen from the above how complicated the question is, and how important is its solution in stock feeding. It will therefore be necessary to continue fermentation experiments on the contents of the paunch side by side with metabolism experiments in cattle, in order to isolate the different factors involved, which are, as the metabolism experiments would lead us to conclude, the result of the intimate connection between digestion and fermentation processes and of the transformations which take place in the animal organs. Already a number of Dr Markoff's experiments with paunch contents show that the presence of ensilaged food modifies very sensibly the fermentation in the paunch, and that under certain circumstances the fermentation losses are considerably diminished by it.

An important result of the experiments hitherto made, in which the 24 hours metabolism experiments in the respiratory chamber were run simultaneonsly with direct lung respiration investigations over a shorter period, is the recognition of the fact that unaltered carbohydrates scarcely enter into the metabolism of ruminants, and that, instead, all the material is transformed by fermentation in the paunch into organic acids and perhaps partially into alcohol. This is clearly seen by the relatively low values of the respiratory quotient of the animals. The low quotients are an index of the oxidation of the nutritive substances which are circulating and being burned in the body; in ruminants these are very different from those taken up in the food, which, in splitting up through fermentation, give off large quantities of carbonic acid together with combustible gases. Of this carbonic acid produced in the paunch very little is resorbed and exhaled through the lungs, the greatest quantity being passed out from the paunch through the oesophagus. In Pettenkofer's apparatus these quantities of gas mingle with the real respiration gases evolved by the oxidation of the fermentation bodies (mainly fatty acids) in the tissues of the body.

Experiments made by direct pulmonary respiration with a food whose complete combustion should give a quotient of 1.0 and even something more, on account of the formation of methane, gave figures between 0.76 and a maximum of 0.92. Parallel experiments in the respiratory chamber yielded the high respiratory quotient as calculated from the composition of the food. A very remarkable difference in the constitution of the organs in cattle and in horses is explained by this transformation of food in the paunch. In horses the liver as well as the muscles are always very rich in reserve carbohydrate (glycogen). In cattle the glycogen content of the organs is very low (1). The explanation is that, in the former the carbohydrates of the food enter as such into the circulation, whilst in ruminants these are completely reduced to fatty acids, from which, in the animal body, only very little, if any, glycogen is formed.

A further series of problems to be solved by respiratory experiments, which have been begun on Carnivora and omnivora, is that concerning the expenditure of energy required for the transformation of food into contituents of the body as it takes place in growth, in fattening, in the production of milk and in the growth of the foetus, as well as in the production of eggs in birds. Investigations into these subjects have recently been undertaken by Von der Heide and Klein (2), Dienes (3), Morgulis, Diakow and Gerhartz. A part of the results of the experiments has already been published. The whole of the work done confirms a fact that Kellner had already pointed out, but which in his works could not appear with due clearness on account of the losses due to fermentation and to the great amount of work required by digestion in herbivorous animals, namely that every assimilation of food in the body is attended by a considerable loss of energy. In other words the excess of food which is given for the purposes of production never accomplishes its object without losses. A considerable proportion is consumed in the chemical processes which transform the food material into organic substance. These losses are greatest in the laying on of proteins, as occurs in growing animals, but they are also very considerable when the fat contained in the food is deposited in the animal body during the fattening process, as has been found in Von der Heide and Klein's experiments with pigs, notwithstanding the fact that into this process chemical changes scarcely enter. The consumption of energy in the growth of the foetus and in the production of milk are more easily recognised by the experiments of Dienes. It appears that in the last days of pregnancy, during which the foetus grows most, and also during lactation, the process of combustion is increased by 26

(1) The difference is so constant that it has been used as a test to distinguish beef from horseflesh.

(2) Von der Heide and W. Klein. Stoff und Energie Ansatz des Schweines bei Wachstum und Mast, *Biochemische Zeitschrift*, 55, p. 195, 1913.

(3) Dienes, S. Beitrag zur Kenntniss des Stoffwechsels in der Schwangerschaft und der Lactation, *Ibid.*, p. 124.

to 29 per cent. This increase is naturally greater the more organic substance is produced. Thus in the case of cows yielding much milk, besides the addition to the rations required to provide the material for the milk, a further considerable supplement must be given to cover the work of production. This supplement is estimated according to the results of preliminary experiments at from 50 to 60 per cent. of the energy of the milk produced. The experiments of Gerhartz on the transformation of energy in the laying hen are more complete than any hitherto made on the production of milk (1). In this work of production, in which a specific material in the form of eggs is produced in large quantities by the animal, the expenditure of work expressed in calories is equal to the whole combustion value of the mass produced.

I hope that with the help of the methods described above and of the investigations now under way it will be possible, in the course of the next few years, to throw so much light on the subject as to enable practical rules for the science of feeding to be drawn up.

(1) The paper is being printed in *Arch. f. d. ges Physiol.*

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

298 - **Legislative Measures Relating to the Trade in Silkworm Eggs.** — *Enquiry made by the International Institute of Agriculture.*

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

In order to obtain information as to the legislative measures dealing with the trade in silkworm eggs (" graine ") at present in force, the Institute addressed a circular letter in September 1913, to the Department of Agriculture of each country in which the raising of silkworms is of importance, asking whether any such measures existed in the country. Further, a special question asked whether it was obligatory that silkworm eggs for sale should have been raised by the Pasteur system.

A large number of answers were received, frequently accompanied by various publications dealing with the subject; the following is a summary of the information received.

Australia. — No special measures or regulations exist in any of the States of the Australian Commonwealth.

Austria. — So far the necessity for special laws has not been felt, as sericulturists, of their own accord, only employ the eggs prepared on the Pasteur system, and the trade has rigourously excluded all material not so prepared. The Agricultural Experiment Station at Görz serves as a sericultural testing station, and, when required, tests the graine and grants certificates.

The Sericultural Institute at Trent, which was created by the agricultural council of the province, produces large quantities of graine, using the cellular method exclusively. The above Institute only began to supply the graine in 1885; at the present day it furnishes about two-thirds of the total quantity required by the country. The whole process of egg production, as well as sericultural courses for men and women, are carried out in the building specially erected in 1894 at a cost of 340 000 crowns (over £14 000).

Bulgaria. — Both the internal trade and the import of graine is regulated by the « Law on the development of the silk industry in Bulgaria ", which dates from January 24, 1906, and contains the following provisions:

Production of graine in Bulgaria may only be carried out under Government supervision and with the use of the cellular system.

In order to become a producer of graine a special permission is required, and the technical operations must be directed, by certificated members of the staff who have attended a sericultural course either in Bulgaria or abroad.

The despatch or consignment of graine is prohibited before March 15.

Producers of graine must give written notice to the Department of Commerce and Agriculture, previous to March 1, as to the amount of graine they intend to produce, and before April 15 must furnish a list of the silkworm raisers who have been provided with graine, as well as the amount provided in each case.

Government inspectors visit the breeding houses and make a rigorous inspection of the microscopical selection work.

In the event of disputes arising between the producers of graine and the Government authorities, matters are refered to the court of justice for trial.

The graine must be put on the market in little sacks containing exactly 10 or 30 gms.; these must be enclosed in boxes bearing the name of the firm which produced them, and the race and weight of the contained graine. Such boxes are further wrapped round with a paper band provided free by the Government. No variation of this system of packing is permitted.

Importation of graine from abroad is allowed from August to November 15 or from February 1 to March 1 if the necessary authorisation has been obtained from the Government, who also inspects such consignments. The graine must have been produced by the Pasteur system, must be pure and unadulterated, and should be accompanied by samples of the cocoons from which it was produced. Imported graine if declared marketable is provided with the official bands mentioned above, but if declared defective or infected must be redispatched abroad immediately by the consignee; in the case of failure to comply with this order within 10 days, the graine is destroyed on the spot. The official bands for imported boxes are charged 5 centimes for boxes containing 10 gms. and 10 centimes for boxes containing more than 10 gms.

The Government suspends for three or five years the importation of graine from firms who do not show proper homogeneity in their samples of cocoons.

Producers in those countries with whom Bulgaria has concluded a commercial treaty are subjected to the conditions laid down in the treaty in question.

A special convention between France and Bulgaria, dating from January 1906, regulates the import trade from that country. The graine must be produced on the Pasteur principle and imported in sacks each containing the moth or in boxes bearing a band which constitutes an official guarantee from the French government, and which allows the boxes to come through without inspection by the Bulgarian officials. Without the band the material must be examined within a month, either by the purchasor under the supervision of Government officials or by the latter themselves. The application of the Bulgarian official band is charged 1.10 fr. per 100 sacks examined if the work has been done by the Government officials, or if the work was done only under the superintendence of Government officials, the charge is 10 centimes and 5 centimes per box of 30 gms. and 10 gms. respectively.

Even with French consignments the purchasor requires Government authorisation, but this cannot be refused unless the graine sent does not correspond with the description on the official band or on the box containing the bags of graine. Importation is allowed from August 1 to December 1, or from February 1 to March 15.

China. — No laws or regulations relating to the silkworm egg trade exist. Only the sericultural schoools put on the market graine which has been subjected to microscopical examination, and such graine is put into boxes bearing the school seal, but the peasant rearers prefer to buy their graine from merchants. The latter collect eggs of various species and indicate the place of production on the wrappers, as well as append their own seal.

Besides the peasant rearers who merely raise silkworms from eggs collected themselves, exercising a rough kind of selection, there are certain rearers who make a special business of producing graine for sale.

The Department of Agriculture and Forests has brought forward proposals for laws and regulations on the silkworm egg trade and the silkworm industry generally, including preventive measures for disease etc., but at a the end of 1913 such proposals had not yet been made law.

France. — The Government control was instituted by a decree on April 26, 1907 supplemented by a ministerial instruction on April 24, 1912. Producers are not obliged to submit to the control but those who do submit receive Government guarantee for their goods.

A special inspector staff is made up of sub-inspectors who superintend the production and boxing of the graine, and of inspectors who organise and direct the operations of the above officials. The inspectors must assure themselves, by means of surprise visits, that the graine is produced exclusively by the Pasteur method, and that the conditions generally warrant the fixing of the official band to the boxes. The sub-inspectors visit the cultivators who raise the cocoons for the graine-producing establishments, as well as the latter themselves.

In the selection of the cocoons, the type and quality of each different lot is examined, and the number making up the lot is noted. Great stress is laid, of course, on the microscopical examination of both pupae and moths.

During the washing, drying, cleaning, and boxing of the eggs, the sub-inspector has to see that no adulteration takes place. He is further responsible for marking the exact weight of eggs on the official band of each box, as well as the name and address of the producer, and the race and colour of the cocoons.

Producers of graine who wish to be under Government control must send in to the State Department of Agriculture a special form every year before March 31, in which they undertake to subject themselves to all the prescribed regulations for both the internal and the external trade, and to furnish Government officials with all the necessary facilities for carrying out their work of inspection.

Greece. — No special regulations exist, but the Government meditate bringing in such measures shortly.

Hungary. — All matters relating to sericulture and the silk industry have been in the hands of a special government department since 1880, *viz.* "The Royal Inspectorate for the Development of the Silk Industry in Hungary". It was decreed by law in 1885 that the Inspectorate alone

should have the right to distribute gratis to all who wished to rear the worms, graine produced by the Pasteur system. The cocoons are then acquired by the Government at a fixed price of 2.35 crowns per kilo (10 ½ *d* per lb.), in which allowance has been made for the value of the graine distributed free. The Government has erected a Sericultural Institute at Szekszard; in this 280 microscopes are kept in use, selecting annually 6 to 7 million pairs of moths for the cells, each pair being subjected to microscopical examination by three different members of the staff. To maintain the racial vigour, about two million cells containing moths are imported annually from Italy or France, and the graine produced by these couples is distributed the following year.

India and British Crown Colonies. — No special regulations exist. In India attempts have been made to induce cultivators to use selected graine exclusively, and facilities for its acquirements have been granted in silk-raising districts. In Ceylon imports of graine have been limited to selected material from Italy or from the Government establishment in Kashmir, and such precautionary measures will undoubtedly be continued in future.

Italy. — No special regulations exist other than art. 15. of the law No. 869, July 6, 1912, dealing with the silk industry, in which it is stated that all silkworm eggs consigned by post or railway and gone astray in transit must be destroyed instead of being sold as is usually the custom with lost goods. Nevertheless there are numerous firms which carry on a business in graine both at home and abroad and which produce their eggs on the Pasteur system and guarantee the material they supply. Further, the two Royal Experimental Stations of sericulture of Padua and Ascoli Piceno, as well as the Sericultural Departments of the Royal Agricultural Colleges of Milan, Portici and Perugia, and numerous other small sericicultural stations (" osservatori ") exert a considerable beneficial influence on the commerce of graine.

Japan. — There exists a fundamental law for the silkworm egg trade dating from March 29, 1911, No. 47, which is known as «san-shi-gyo-ho." Other regulations concerning the execution of this law are as follows:

a) Imperial decree of July 29, 1911 (No. 214), on the right of inspecting graine.

b) Imperial decree of November 22, 1911 (No. 276), on the organisation of a committee for the inspection of graine.

c) Decree of the Department of Agriculture and Commerce of November 3, 1911 (No. 30), relative to the application of the above law.

d) Instructions issued by the Department of Agriculture and Commerce, December 16 1911 (No. 19) relating to the said law.

e) Notification from the Department, December 6, 1911 (No. 571), relative to preventive measures against silkworm diseases.

f) Ministerial decree, 1911 (No. 31), with regard to the organisation of the Bureau of Inspection for Sericulture.

g) Ministerial decree, May 1, 1911 (No. 21), relating to the subvention granted for encouragement of improved methods in the production of graine.

Japanese law lays down that all graine put on the market must have been produced by the Pasteur system, details being given in the above - mentioned document (*e*).

Roumania. — No special laws are in existence. Imports are all subjected to examination by the sericultural station before being allowed to circulate in the country. All graine must be produced by the Pasteur system and be free from all disease.

Russia. — No special laws exist, but measures are now being discussed in this connection.

Spain — A royal decree dating from May 16, 1913, prohibits all imports from France unless the latter bear the official bands which constitute a Government guarantee. Imports from other countries are subjected to no special regulations and the graine may be either cellular or industrial; in fact, it more usually consists of the industrial variety.

299 - **The Institution of a Technical Commission of Agricultural Meteorology at the "Direction générale des Eaux et Forêts" in France.** — *Ministère de l'Agriculture, Bulletin mensuel de l'Office des Renseignements agricoles*, Year 13, No. 1, p. 8. Paris, January 1914.

By a Ministerial Decree of January 6, 1914, a technical commission of Agricultural Meteorology has been established at the French Ministry of Agriculture. The commission consists of 30 members who are nominated for three years by Ministerial decree, and it is attached to the " Direction Générale des Eaux et Forêts». Its duty is to give its opinion upon the studies to be carried out in the different agricultural districts of France, upon the establishment and management of the Stations and Posts of Observation and upon all question laid before it by the Ministry of Agriculture.

300 - **Some Data on the Agriculture of the German Protectorates.** — *Die deutschen Schutzgebiete in Afrika und der Südsee* 1912-13, *Amtlicher Jahresbericht, herausgegeben vom Reichs-Kolonialamt*, pp. 82-111 and 121-128. Berlin, 1914.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

The following data on the agriculture and trade of the German Protectorates are taken from the official report of 1914 published by the Imperial Ministry for the Colonies on the German Protectorates.

Among the various branches of German colonial economy, agricultural produce occupies the first place. During the year dealt with by the Report, the plantations enjoyed, in the main, favourable market conditions, as the effects of the low prices for rubber were not yet much felt. The rubber plantations in Germany East Africa have been considerably extended. Sisal yielded a good crop which sold easily at good prices. The production of coffee increased. The plantations in Kamerun are progressing; a new branch, bananas, has a good prospect for the future, owing to the formation of a firm for their export. In Togo the plantations have increased in number and in extent. In German New Guinea also, the area under plantations has considerably increased. It is satisfactory to note the progress in the growing of other produce, such as rubber and cacao, besides coconuts, because the exclusive production of copra presents serious drawbacks from the point of view of colonial economics. At Samoa the cultivation of Hevea has made much progress.

TABLE I.

	German East Africa		Kamerun		Togo		South Sea Protectorates: German New Guinea and Islands		South Sea Protectorates: Samoa	
Total area	1 339 637 acres		284 539 acres		28 091 acres		457 000 acres		122 460 acres	
Number of plantations	707		58		—		—		34	
White employees	606		195		9		212		81	
Coloured labourers	83 366		17 827		841		15 116		2 118	
	Cultivated area		Cultivated area		Cultivated area		Cultivated area		Cultivated area	
Crops	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres
Maize	9 365	9 365	—	—	—	—	—	—	—	—
Rice	1 152	1 152	—	—	—	—	72	32	—	—
Sugarcane	341	341	—	—	—	—	94	94	—	—
Other cereals	5 807	5 807	—	—	—	—	7	5	—	—
Coconuts	20 209	4 900	—	—	1 628	660	73 228	26 540	12 080	9 585
Oil palms	257	15	12 564	4 070	145	—	—	—	—	—
Pineapples	—	—	—	—	—	—	10	10	25	25
Bananas	383	383	5 347	976	—	—	12	5	238	238
Fruit trees	608	608	—	—	—	—	—	—	—	—
Other fruit	568	568	—	—	—	—	158	158	23	23
Cacao	297	173	32 522	20 201	452	198	974	507	8 928	3 740
Coffee	11 869	5 414	264	25	—	—	22	15	7	7
Tobacco	40	40	378	227	—	—	7	7	—	—
Spices	(Pepper) 136	136	(Kola) 405	44	(Kola) 1	1	(Kola and nutmeg) 20	5	(Kava(*)) 47	47
Rubber	111 982	42 295	18 291	2 555	430	49	5 780	2 963	2 871	533
Cotton	31 978	41 978	—	—	—	—			—	—
Kapok	6 504	1 584	—	—	12	—	—	—	18	18
Manila hemp	—	—	—	—	—	—	20	15	—	—
Mauritius hemp	—	—	—	—	—	—	—	—	—	—
Sisal hemp	61 162	35 482	—	—	650	168	193	69	—	—
Fourcroya	—	—	74	54	—	—	—	—	—	—
Total	262 657	140 242	69 745	28 152	3 318	1 076	79 597	30 425	25 237	14 216

(*) Piper methysticum. (Ed.).

Table I gives a synopsis for 1912 of the plantations belonging to Europeans in all the German Protectorates.

Farming in German South-West Africa has not yet felt all the benefits expected from the new railways, but it has nevertheless developed very satisfactorily. Notwithstanding the small amount of rain and the poor pasturage, the live stock of the farms has increased as well as the number of the latter. In 1913 there were 1 331 farms comprising 33 096 806 acres, against 1 245 farms with 32 001 861 acres in the previous year.

Table II shows the number of head of Live stock in German South-West Africa in 1912 and 1913 and those of East Africa and German New Guinea in 1913.

TABLE II.

Live stock	German South-West Africa 1912	German South-West Africa 1913	German East Africa 1913: belonging to Europeans (501 farms)	German East Africa 1913: belonging to natives (*)	German New Guinea 1913
Cattle	171 784	205 643	43 617	3 950 250	2 572
Sheep for wool	46 901	53 691			
Persian sheep	12 588	17 171			
Karakul sheep	4 094	11 194	41 647	6 398 000	sheep 891
African sheep for meat	422 481	472 585			
Angora goats	10 387	18 163			
Horses	448 279	485 401			goats 556
Asses	13 340	15 916	202	10	421
Common goats	7 015	8 563	2 543	22 091	17
Mules	4 879	5 055	375	52	6
Pigs	7 195	7 772	5 460	497	2 706
Camels	789	709	—	38	—
Ostriches	1 277	1 507	173	—	—
Poultry	71 753	87 386	—	—	15 019

(*) The figures of this column are mostly estimated.

The establishments of the Administration for the Promotion of Agriculture have continued to develop and have displayed great activity, especially in German East Africa, where their number has reached eight. Extensive veterinary measures for the control of cattle plague have been organized in the colony. The campaign against the diseases of live stock has been continued in German South-West Africa. In German New Guinea the bases of a veterinary service have been laid.

In Samoa agricultural experimentation has been newly organized and special attention is paid to the phytopathological service, while it continues its development in German New Guinea.

For forestry the chief measures have consisted in the creation of new forest reserves, especially in East Africa and in Togo. The forest reserves n East Africa extended, in 1913 (April 1), over an area of 1 833 817 acres, against 1 197 040 in 1912.

The foreign trade of all the Protectorates rose in 1912 to £12 890 000 (£11 760 000 in 1911), which is principally due to the total increase of Trade in East Africa; this rose from £2 330 000 to £2 970 000. The total import trade of all the Protectorates has risen from £6 968 398 to £6 991 268; while the exports have risen from £4 801 818 to £5 923 126. To this increase of exports German South-West Africa has contributed £540 000 and German East Africa £440 000.

Table III shows the principal animal and vegetable products exported, arranged according to value.

TABLE III.

	£		£
Rubber	1 036 242	Timber	41 829
Copra	573 520	Wax	40 624
Palm kernels	381 500	Cattle	26 259
Sisal	361 114	Sesame	25 662
Cacao	265 296	Maize	14 150
Hides	212 268	Butter, milk, etc.	12 630
Palm oil	148 727	Rice	9 646
Cotton	128 621	Kola nuts	8 181
Coffee	93 284	Wool	7 333
Earthnuts	62 380	Tanbarks	4 892
Ivory	46 011	Ostrich feathers	4 753

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY.

301 – **The Establishment of a Laboratory at the Marseilles Colonial Institute for the Study of Cereals and other Starch-producing Plants.** — PERROT, EM. in *La Quinzaine coloniale*, Year 17, No. 34, pp. 861-862. Paris, December 25 1913.

The Marseilles Colonial Institute has decided to erect a laboratory for the special study of cereals and other starch-producing plants cultivated in the French possessions. This laboratory will be furnished with all the apparatus necessary for grinding and baking experiments with cereals, for husking, bleaching and testing the hardness of rice, and for experiments on obtaining starch and alcohol from other starch-producing plants. These technical investigations will be supplemented by the necessary botanical determination of the plants, and by their chemical analysis.

AGRICULTURAL SHOWS AND CONGRESSES.

302 – **Agricultural Shows.**

Austria.

1914 June-July. Vienna. — Flower show of the Imperial Horticultural Society. Offices: 12 Kaiser Wilhelmring, Vienna.

Sept. 5-8. Bruck. — Agricultural and industrial show, organized by the "Niederösterreichischer Landeskulturrat" in conjunction with the municipality of Bruck and the local Agricultural Association. Offices of the "Landeskulturrat": Stallburggasse, 2, Vienna I.

Belgium.

1914 Aug. 15-18 Huy. — Septennial International Horticultural and Agricultural Show. Adress to: M. Paul Maréchal, Statte Huy, Belgium.

Nov. 7-9. Brussels, Grand Hall du Cinquantenaire. — International Poultry Show, organized by the "Société centrale d'Aviculture de Belgique". Offices: Royal-Bourse, rue Henri-Mans 13-14, Brussels.

France.

1914 May 26-31. Caen. — National poultry show, organized by the "Société d'Aviculture de la Basse-Normandie". M. Hédiard, 37 rue de Bretagne, Caen.

May 29-June 1. Biarritz. — International Show of Horticultural Produce, held at the time of the 18th Congress of the "Amis des Roses, Société française des Rosiéristes", under the auspices of the "Société d'Acclimationta du Golfe de Gascogne". M. Hurn-Sentouré, general sec., Société d'Acclimatation, Biarritz.

June. Paris. — Exhibit of useful and injurious insects and of insectivorous birds, under the patronage of the Ministry of Agriculture. The profits will go towards the foundation of Entomological Stations and Laboratories.

June 16-21. Paris, Champ de Mars — Second General show of Breeding Stock (cattle, sheep and pigs) organized by the Minister of Agriculture. The show of stud horses and asses will be held at the same time.

Germany.

1914 Frankfort-on-the-Oder. — Three Horticultural Shows will be held by the Frankfort Horticultural Society in connection with its fiftieth anniversary, *viz.*: May 2-4, Aug. 15-17 and Sept. 19-21. Director: H. Steffen, Gebenerstrasse 18, Frankfurt a-O.

May 23-26. Magdeburg. — 25th show and sale of horses and exhibition of agricultural machines, with show of sheep, sheep-dogs and poultry.

Hungary.

1914 September. — The sale and show mentioned in *B.* March 1914, p. 325, has been put off to September.

Italy.

1914 Autumn. Vercelli (Piedmont). — Competition for mechanical cultivation of rice-fields, organized by the "Stazione Sperimentale di Risicultura".

Rumania.

1914 May. Bukarest. — Agricultural show with competition for motor ploughs.

Russia.

1914 May 20-June 7. Warsaw. — International show of agricultural machines with internal combustion engines, organized by the Central Agricultural Society of Poland.

Union of South Africa.

1914 Agricultural shows: May 6-7, Hooptad (Orange Free State); May 22-25, Pretoria; June 11-12, Pietersbury (Transval); July 7-10, Durban.

United Kingdom.

1914 June 30-July 4. Shrewsburg — Royal Agricultural Society's Show.

July 7-8. Cork. — Munster Agricultural Society's Show.

July 21-23. Newport (Mon.). — Welsh National Agricultural Society's Show.

Nov. 19-21. Norwich. — Fat stock show of the Norfolk and Norwich Christmas Show Association.

Dec. 7-11. Islington. — Fat stock show of the Smithfield Club.

303 – Agricultural Congresses.

France.

1914 May 29-June 1. Biarritz. — 18th Congress of the "Amis des Roses, Société française des Rosiéristes". M. Hurn-Sentouré, general sec. of Société d'Acclimatation, Biarritz.

Sept. 4-6. Lyons. — Annual congress arranged by the "Union nationale des Sociétés d'horticulture de France". Special subject: fruit-growing and the fruit trade. M. Charles Balter, sec. of the Union, Faubourg de Croucels, Troyes.

Sept. 7 (opening). Grenoble. — Pomological Congress, organized by the "Société Pomologique de France".

CROPS AND CULTIVATION.

[...]ULTURAL [...]OROLOGY.

304 – **The Frequency of Low Temperatures in the Sudan and its Effect on the Cotton Crop.** — HURST, H. E. in *The Cairo Scientific Journal*, Vol. VII, No. 87, pp. 265-268. Giza, December 1913.

During the season 1910-11, a very poor cotton crop was obtained at Atbara; this was attributed to the low temperatures experienced in the months of November and December. The actual temperatures registered were 12 readings of 11° C. or lower, while in ordinary years only about 4 such low readings are registered, so that the damaging limit lies probably between 4 and 13 occurrences of 11° C. or lower. The writer tabulated the frequencies of low temperatures (11° C. or lower) registered at various points in the Sudan during the years 1902-1912, and then calculated the probability of the occurrence of 8 or 9 such low temperatures in one year at these different points. He points out that the results are only approximately correct, as the available records only cover a small number of years, also that more research is required as to the actual temperature conditions required to damage the cotton crop; but, assuming that low temperature alone was responsible for the damage to the cotton crop at Atbara in 1910, the results indicate that cotton cannot be grown in the neighbourhood of Atbara and Dueim without considerable risk, while at Khartoum the risks are less, though further investigations are required to define them exactly; but at Wad Medani, Kassala and Tokar there seems to be little danger from cold weather.

An accompanying chart shows that the dividing line between safe and doubtful districts seems to follow roughly the isotherm of mean minimum temperature for the time of year of 16° C. Consequently, before much cultivation is commenced in the Western Gezira, the exact effects of low temperature on the growth of cotton should be investigated.

305 – **Rainfall and Spring Wheat.** — BLAIR, T. A. in *Monthly Weather Review*, Vol. 41, No. 10, pp. 1515-1517. Washington, October 1913.

The influence of rainfall on the yield of spring wheat is estimated by calculating the departure from the normal of the annual yields, and of the rainfall, during the months of May and June, for the 22 years 1891-1912. The data refer to the States of Minnesota, North Dakota, and South Dakota, and the results indicate that while the rainfall during the growing season is the chief determining factor with regard to the wheat yield in the two Dakotas, this is probably not the case in Minnesota, where much of the land is badly drained, and the best crops are obtained in years when the precipitation is normal or slightly subnormal.

306 – **Relation of Precipitation to Tree Growth.** — STEWART, M. N. in *Monthly Weather Review* (*U. S. Dep. of Agr.*), Vol. XVI, No. 9, p. 1287. Washington. September 1913.

The width of the rings in an oak stump was measured and compared with the rainfall records of the district over a period of 75 years. June and July appear to be the two months whose rainfall is most closely connected with tree growth; considering only the precipitation of these two months, practically all rings more than 10 per cent. below the average width were formed in years of subnormal rainfall, while 62 per cent. of the rings above the average width correspond with years when the rainfall was above the average.

307 – **Recent Studies of Snow in the United States.** — CHURCH, J. E. Jun. (University of Nevada) in *Quarterly Journal of the Royal Meteorological Society*, Vol. XL, No. 169, pp. 43-52. London, January 1914.

A description of the instruments used by the writer in surveys, and of his methods of working, together with some observations on the relation of mountains and forests to the conservation of snow, the principal results of which have already appeared in this *Bulletin* (1).

308 – **On a New Method of Measuring the Capillary Lift of Soils.** — LYNDE, C. J. and DUPRÉ, H. A. in the *Journal of the American Society of Agronomy*, Vol. V, No. 2, pp. 107-116. Lancaster, Pa., April-June, 1913. SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

Small glass funnels (4 cm. in diameter across the top) were fitted with cotton cloth filters, cut in the form of a circle 2 cm. in diameter and folded like a filter paper. Soil samples were boiled in water, and a little of the hot mixture was poured on to the filter, the funnel was placed in a centrifuge cup, already containing water, and centrifuged, the process being repeated till the layer of soil settled on the filter reached well above the edges of the cotton cloth fibres. The lower end of each funnel was then connected with a vertical capillary tube filled with water, the other end of the tube dipping into a basin of mercury, so that the whole constituted a continuous water column from the lower surface of the soil layer to the surface of the mercury. As water evaporated from the upper surface of the soil, the mercury rose in the capillary tube and the *capillary lift* could be measured. A subsoil containing 74 per cent of clay and various soil fractions were tested as follows: (Table I).

The theoretical capillary lift was calculated for the different soil fractions, and in all cases except the clay fraction, the observed values fell between the limits of the calculated values. In the case of the clay, the calculated value surpassed 34 feet of water or the height of a column supported by one atmosphere. Some soils that were tried also gave higher calculated values than 34 feet of water, and in all these cases the observed values remained below the 34 feet. From this, the writers concluded that the pressure of the atmosphere limited the capillary lift which could be observed, and therefore, that if the pressure were increased, it would follow that the capil

(1) See No. 462, *B.* May 1913.

TABLE I.

Soil	Diam. of soil particles	Capillary lift	
		Mercury column	Equivalent water column
	mm.	cm.	feet.
Subsoil containing 74 % of 'clay'	—	67.5	30.1
Sand (medium)	0.5–0.25	2.2 2.1	0.98
Sand (fine)	0.25–0.1	4.0 3.9	1.78
Sand (very fine)	0.1–0.05	9.1 8.8	4.05
Silt	0.05–0.005	22.4 21.3	9.99
Clay	0.005–	60.1 55.9	26.80

lary lift would be increased too, and vice versa. To this end the whole apparatus described above was enclosed in a glass case where the pressure could be controlled, and, working with clay the following results were obtained : (Table II).

TABLE II.

Pressure cm. of mercury		Capillary lift, cm. of mercury
76	Normal Pressure	55.9
76		60.1
99.5		86.3
104.2		78.4
61.3		56.3
56.3		44.3

The writer points out that one of the great advantages of this new method of measuring the capillary lift is the rapidity with which observations may be made. In the experiments on the subsoil given in Table I the lift of 30.1 feet took place in 20 hours.

309 - **On Osmosis in Soils: The Efficiency of the Soil Constituents as Semi-permeable Membranes.** — LYNDE, C. J. and DUPRÉ, H. A. in *the Journal of the American Society of Agronomy*, Vol. V, No. 2, pp. 102-106. Lancaster, Pa., April-June, 1913.

In previous investigations (1), it has been shown that a clay subsoil, centrifuged into a dense layer about 2 inches thick, or more, in the bottom of a

(1) See No. 645, *B.* June 1913.

cylinder, acts as a semi-permeable membrane whose efficiency varies with the depth of the column of clay. In the present paper, the efficiency of the various soil fractions to form this membrane was tested with the following results:

Soil fraction	Diameter of particles	Depth of soil column	Osmotic pressure per sq. cm.	Resistance of solution	Efficiency of soil column compared with a perfect semi-permeable membrane
	mm.	cm.	gms.	ohms.	per cent.
Sand (medium)	0.5 —0.25	7	0	—	—
» (fine)	0.25 —0.1	7	0	—	—
» (very fine)	0.1 —0.05	7	0	—	—
Silt	0.05 —0.005	8	0.2	850	0.07
Clay	0.005-0.001	6.5	4.4	1 400	2.6
Fine clay.	0.001—	5.5	42.0	1 500	27.1
Clay remaining in suspension for a week . .	—	6.0	315.0	—	—

The efficiency increased as the size of the particles diminished, and, while fractions made up of particles over 0.05 mm. in diameter were quite ineffective, that consisting of particles which had remained in suspension for a week had already reached an osmotic pressure of 315 gms. per sq. cm. when the article went to press, and the pressure was still increasing. The solutions used were clay subsoil solutions.

310 – **Estimation of the Surface of Soils.** — HANLEY, J. A. (Rothamsted Experiment Station) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 58-62. Cambridge January 1914.

An investigation into the possibility of estimating colloids in soils by means of dye solutions.

Three soils were selected which contained 3 per cent, 8 per cent, and 20 per cent of clay respectively, and 12 solutions of methyl violet were prepared varying in strength from 0.25 gms. to 3 gms. per litre. Five grams of air dry soil were shaken up with 100 cc. of each solution, and left in contact for 48 hours, then part of the top solution was pipetted off, diluted suitably, and the dye estimated colorimetrically by means of Nessler tubes and a standard dye solution. The amount of dye absorbed per 100 dry soil was calculated, and plotted against the concentration of the final solution.

The results yielded three curves which show that when compared on the basis of the concentration of the final solution instead of that of the original solution, the ratio between the amounts of dye absorbed by the three soils remains practically constant for various concentrations, and is

equal to 0.74 : 0.86 : 1 for the soils containing 3, 8, and 20 per cent of clay respectively. In other words, to obtain relative values indicating the active surfaces of different soils, it is necessary that each soil be brought into equilibrium with a solution of the same strength, and as some soils absorb more dye than others, a solution of different strength must be used for each soil.

The writer adopted a standard equilibrium solution of 0.05 per cent, and is continuing his investigations as the method is simple and likely to prove useful as an index of certain physical qualities in soils.

311 - **The Humus of Acid and Alkaline Peats.** — HANLEY, J. A. (Rothamsted Experiment Station) in *The Journal of Agricultural Science*, Vol. VI, No 1, pp. 63-76. Cambridge, January 1914.

A collection of peats, received at the Rothamsted Laboratory from various parts of England was investigated with a view to establishing a chemical distinction between the different classes of such soils, and more especially between the alkaline or normal peats and the acid peats.

In 35 soils the humus was extracted with 4 per cent ammonia before and after treatment with $\frac{N}{5}$ hydrochloric acid, and the results showed that a soil might be alkaline, and yet have a considerable amount of its humus soluble in ammonia without previous acid treatment. In a number of calcium carbonate determinations carried out simultaneously, no soil acid to litmus contained carbonate, while all the alkaline soils did.

Five soils were then selected for more detailed study along the following lines: the nitrogen was estimated in the ammonia extracts obtained before and after acid treatment, and in similar extracts made with a soda solution of equivalent strength to the 4 per cent ammonia; the proteins were hydrolysed with 20 per cent hydrochloric acid and the ammonia thus formed was estimated; finally the soils were boiled in a sucrose solution, and the amount of sugar inverted was estimated. At the same time water cultures were carried out where the only source of nitrogen to the plants was supplied in the form of the peat itself added to each bottle.

Of these various methods of comparison: the alkaline extracts yielded no safe guide to the acidity of a soil though soda gave more significant results than ammonia in this respect. Neither was the hydrolysis of proteins of any use in discriminating between peats, the yield of ammonia with 20 per cent hydrochloric acid being very low in normal peats, and nil in acid peats. On the other hand, the inversion method apparently yielded useful results which agreed closely with the general characteristics of the peats, and this method of comparison was extended to a number of other peat soils. The reaction being one in which neutral compounds cannot taken part, and depending on the concentration of the acid present, the alkaline or normal soils always gave lower results than acid soils, and treatment with 5 per cent hydrochloric acid invariably led to an increase of the inverting power of a soil though every precaution was taken to get rid of the last trace of hydrochloric acid. Moreover normal fertile soils, which would be expected

to contain a large proportion of their organic matter as available humus, always gave more "total inversion" than acid soils.

312 - **The Solution and Precipitation of Iron in the Formation of Iron Pan.** — MORISON C. G. T. and SOTHERS, D. B. (School of Rural Economy, Oxford) in *The Journal of Agricultural Science*, Volume VI, Part I, pp. 84-96. Cambridge, January, 1914.

The formation of iron pan, or Ortstein, which is of fairly frequent occurrence in Europe, has been accounted for by three different theories. According to the first and second theories, the phenomenon is due to the alternate reduction and oxidation of iron compounds — humates in the one case, and oxides in the other — the reduction being brought about by the organic matter in the peat, and being followed by the solution, washing down, and subsequent oxidation and re-deposition of the iron compounds at the pan level. The third and more modern theory considers the formation of pan to be due to colloidal humus compounds of iron and aluminium which are carried down into the soil and there precipitated by soluble salts, by loss of water, or by change of bases. The experimental evidence in support of this last theory did not appear conclusive, and for this reason the writers re-examined the subject.

They worked with iron compounds, as both the ferrous and the ferric ions yield very delicate tests.

In a preliminary set of experiments in which soil, ferric oxide or powdered limonite was boiled with peat and various reagents, it was shown that though the peat had a strong reducing action on any iron salts present, it had no direct action on ferric oxide itself, unless some body capable of bringing small quantities of iron into solution were present. As ammonium chloride was apparently the most efficient reagent for this purpose, it seemed possible that ammonium salts present in peat might play some part in aiding the solution of ferric oxide in the soil, especially as, on analysis, the ammoniacal nitrogen of a series of peats proved in most cases very many times greater than that found in ordinary soils.

A second series of experiments was therefore carried out, in which precipitated ferric hydroxide was shaken up 1) with water containing carbon dioxide, 2) with humic acid, 3) with both these substances, and 4) with ammonium chloride in addition; in other bottles, soil was shaken with peat and carbon dioxide water, with and without ammonium chloride. Neither at ordinary room temperature not at 20° C. could any ferrous or ferric reaction be detected in the solution; under these circumstances, therefore, the ammonium chloride had no effect in bringing iron into true solution. But when these same solutions were evaporated to dryness and ignited, and the residues were redissolved in hydrochloric acid, the reaction for ferric iron was obtained, showing that the original solution must have contained some iron in the form of a complex ion or a colloid sol.

In a further set of experiments an attempt was made to measure the amount of iron thus removed. The results, though not very reliable, confirmed the evidence obtained previously, in that conditions which would increase or decrease sol formation also increased and decreased the amount of iron present.

Again, a solution of ferrous humate was prepared by heating together peat, distilled water and iron filings; the solution obtained gave a strong ferrous precipitate with potassium ferricyanide. When oxidised with hydrogen peroxide, a slight brown precipitate was formed; on filtering this off, the resulting solution, though it gave no reaction for ferrous or ferric iron was shown to contain a colloidal sol of iron, similar to those obtained before. Whether this is a colloidal sol of true ferric humate or a colloidal absortion complex of colloidal humus and colloidal ferric hydrate is not yet clear.

Lastly, on analysing the residue of a solution containing such a colloid suspension extracted from a soil, it was found to consist mainly of iron, aluminium and calcium, with traces of magnesium, showing that aluminium and calcium are also involved in the formation of the pan.

The writers follow out the process of pan formation according to the evidence obtained in their experiments, as follows: one of the first results of the accumulation of the surface layer of peat is the production of substances showing acid properties, which will remove the more readily attacked constituents of the soil — probably in the state of true solution. At the same time there are formed colloidal humates of iron, aluminium and calcium, but, owing to the fact that the soil solution is at first comparatively concentrated, these colloids are probably in the gel form, and are not removed from their original position. When the soil solution has become sufficiently dilute, the gels assume the sol form, and are removed from the layer which ultimately becomes the bleached sand layer lying immediately under the peat (*i. e.* go into suspension in the soil solution). This occurs during the wetter part of the year. As the soil dries up, the water recedes from the surface, and the major part of the colloidal suspension is taken with it. As desiccation proceeds, the soil solution becomes more concentrated with respect to the colloid, and deposits more ferric humate at the lower level, and, owing to the negligible osmotic pressure of the colloid sol, little diffusion will take place. Consequently desiccation will be more rapid than diffusion, and the whole of the material in suspension will be deposited. When the wet season recurs, the coagulated and desiccated colloids will not entirely go back into suspension, as the colloid character may well have been changed during the process of desiccation.

It is conceivable that some of the the iron bacteria may play a part in the formation of the pan, but the writers consider that it is possible to account for its formation without the intervention of living organisms.

313 - **Ferrous Iron in Soils.** — MORISON, C. G. T. and DOYNE, H. C. (School of Rural Economy, Oxford) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 97-101. Cambridge, January 1914.

The writer shows that the present methods of estimating ferrous iron in soils are quite unsatisfactory. They consist essentially in the use of dilute acid as a solvent, and of subsequent titration with potassium permanganate. As has been shown previously (1), soils boiled with such dilute

(1) See No. 312 *B*. April 1914.

acids, in presence of organic matter, have their ferric salts reduced to ferrous, therefore the amount of ferrous iron estimated depends on three independent factors :

1) The amount of ferrous iron present,
2) » » » soluble ferric iron present,
3) » » » organic matter present.

314 - **The Nature and Amount of the Fluctuations in Nitrate Content of Arable Soils.** — RUSSELL, E. J. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 18-57. Cambridge, January 1914.

Systematic determinations of the nitrate content of soils were carried out during the four years 1909-13, the results of which are brought together in the above paper. The soils studied varied from sands to clays, and they were sampled to a depth of 18 inches in two layers (0—9 in. and 9—18 in.), each layer being considered separately.

The results disclose the remarkable fact that the accumulation of nitrates in the soil takes place most rapidly in late spring or early summer (Mays, June, July), and not in the late summer as in often stated, the actual period of the rise varying with the character of the season, being earlier after a dry cold winter than after a wet mild one. Subsequently to this accumulation, the nitrate content appears to depend partly on the nature of the soil and its treatment, and partly on the season. On fallow land, there is usually little, if any, subsequent gain, and frequently a loss, but in the hot, dry season of 1911 the accumulation continued on some soils right on till September.

The maximum nitrate content of the soils rarely exceeded :

6 parts of nitrogen per million of dry soil, or 28 lbs. per acre for a sand,
23 » » » » » » » » » 115 » » » » » loam,
(excepting on heavily dunged land when it rose to 37 parts per million)
14 parts of nitrogen per million of dry soil or 60 lbs. per acre for a clay.

Loams showed greater fluctuations in nitrate content than either clays or sands. Clays lost less nitrate in winter, but also accumulated less in June and July, while sands were reduced to the same low level as the loams in winter and never accumulated much in summer. The rainfall during the winter greatly affected the amount of nitrate lost by loams and sands, a wet autumn or winter proving very disastrous, and much evidence was accumulated in this connection to show that all winter losses of nitrate are due to leaching rather than to denitrification.

On cropped land, the nitrate content was always lower during the late summer and early autumn than on corresponding follow land, even after allowing for the nitrogen taken up by the crop. In fact no evidence could be obtained that any nitrate was being produced during the time of active plant growth in the hot summer of 1911, although nitrate accumulation was taking place on adjacent fallow land. In some cases the nitrate content rose again after harvest. Moisture determinations and temperature readings on fallow and cropped soils only showed small differences, but it

is impossible to say how far these reacted on the rate of nitrate production. Other observers have noted this same phenomenon of a reduced nitrate content on cropped soils in such dissimilar localities as India, New York State, and Paris, but no solution is at present suggested to explain the results.

The investigation included a study of variously manured plots; ammonium salts nitrified more or less rapidly and completely according to the season and the time of application. Ammonium salts applied in February 1909 were not completely converted at the end of 7 weeks, but another dressing applied in April was completely nitrified in 4 weeks. With regard to the residual effect of ammonium salts, plots habitually receiving annual dressing of ammonium salts contained more nitrates than similar unmanured plots, though none had received dressings in the actual year of the experiment; but when the matter was investigated on two Broadbalk wheat plots which received ammonium salts in alternate years, no evidence of residual nitrogen was obtained.

The writer points out that the general conditions favouring nitrate accumulation are also those favouring crop production. He tabulates two sets of Rothamsted experiments which show clearly the depressing effects of wet winters on crop production, and how intimately this is connected with the leaching out of the nitrate. He further remarks that it is important that agriculturists should realise what great accumulations of nitrate occur in the soil at the end of a dry summer, and how complete may be the loss on loams and sands during a mild, wet winter: 50 lbs or more of nitrogen per acre may easily be lost while the land lies bare between harvest and seed time, and this amount is all that is taken out of the soil by a 32 - bushel wheat crop. As time goes on and the price of nitrogen manures rises, the problem of reducing winter losses of nitrate is likely to increase in importance, and it is now being attacked by experiments in green manuring.

Results obtained by Leather at Pusa, and Jensen in South Dakota, are discussed in their bearing on the present investigation; they support the general rule that when a period unfavourable to nitrification comes to an end, and more favourable conditions set in, the rate of nitrate accumulation tends to be more rapid in the early part of this new period than later on.

Though other investigators have suggested other reasons for this phenomenon, the matter is readily explainable on the view that the soil population is complex and includes two groups of organisms, one of which is engaged in the production of plant food, while the other is detrimental and somewhat more readily put out of action by adverse conditions.

The method of estimating nitrates at the Rothamsted Laboratory is given in detail. It consists of reduction by means of a zinc-copper couple, and has yielded very reliable results over a large series of trials.

315 - **The Effect of Heat on Hawaiian Soils.** — KELLEY, W. P. and MCGEORGE, W. in *Hawaii Agricultural Experiment Station, Bulletin* No. 30, pp. 5-38. Washington, D. C., December 1913.

Hawaiian soils are characterised by: 1) the peculiar properties and high percentage of the clay; 2) the inertness of the unploughed and unbro-

ken sod lands. A field ploughed for the first time, even when reduced to a state of fine tilth, usually will not support plant growth satisfactorily, so that local farmers find it necessary to aerate newly ploughed lands for a period of several months before planting the first crop.

Heat, however, appears to be able to accomplish the effects of aeration, since excellent growth of crops is obtained on plots where brushwood has been burned, even when applications of fertilisers are unsuccessful.

In these experiments, twelve different soils representing a wide range of types and agricultural conditions were studied with reference to the effects of heating to 100° C., to 250° C. and to ignition. The solubility of all the mineral constituents, except soda, was determined, using water and $^{N}/_{5}$ nitric acid as solvents. A study of the changes that take place in the individual nitrogen compounds was also made.

The results showed considerable variation with regard to the absolute and relative solubility of the inorganic constituents in the different samples. Drying at 100° C. was found to bring about an increase in the water-soluble manganese, lime, magnesia, phosphoric acid, sulphates and bicarbonates. The solubility of potash silica and alumina was increased in about half the soils examined, but in some cases it was decreased, while the solubility of iron was decreased in most cases.

Heating to 250° C. or ignition produced effects similar to those brought about at 100° C., but varying in degree, being sometimes greater and sometimes less.

The solubility in nitric acid was not greatly affected by heating to 100° C., but in some instances heating to 250° C. considerably increased the solubility of alumina, manganese, potash and phosphoric acid, and, at the same time, effected a reduction in the solubility of lime and magnesia. Upon ignition, the solubility of alumina, silica, potash, phosphoric acid and sulphates was increased, while the solubility of lime and magnesia underwent a corresponding decrease.

The solubility of the constituents of soils used in aquatic agriculture is abnormally high, but on drying out it becomes more similar to that of aerated soils. When such soils are heated after drying, they seem to undergo changes of the same order as those produced in dry-land soils.

The most important factors affecting the solubility of soil constituents are believed to be of a physical nature, and are attributed to the behaviour of colloidal films adhering to the soil particles. The more important factors of a chemical nature are the deoxidation of manganese dioxide, oxidation (particularly of iron), double decomposition and dehydration. At high temperatures bicarbonates become converted into carbonates, thus effectively lowering the solubility of lime and magnesia.

With regard to the nitrogeneous constituents, nitrates undergo decomposition at 150° C., being practically totally destroyed at 250° C., while ammonia is formed in abnormally large amounts at 200° C. Soil which had been subjected to burning in the field was found to undergo stimulated ammonification after heating. Nitrification on the other hand was not restored after the lapse of two months. Heating to 200° C.

caused a loss of approximately 25 per cent. of the total nitrogen. The loss of nitrogen, and of the ammonia formed by the action of heat, came largely from the monamino-acid group, and to a less extent from the amides and diamino-acids.

316 - **The Rice Soils of Hawaii.** — KELLEY, W. P. in *Hawaii Agricultural Experiment Station, Bulletin* No. 31, pp. 3-23. Washington, D. C., January 1914.

The rice soils of Hawaii are typical laterites, and in mechanical composition resemble clay loams with a rather high organic content. The clay is not composed of kaolin, but consists of ferric and aluminium hydrates with double silicates of iron and aluminium. Chemical analysis shows that they are generally rich in nitrogen and phosphoric acid but poor in potash.

Manurial experiments showed that the best results are obtained by using ammonium sulphate as fertiliser. Organic nitrogenous manures give better results if applied sufficiently early to enable decomposition to begin before planting the rice. Nitrates may produce a decrease in the crop owing to the formation of poisonous nitrites.

Experiments on the rate of ammonification of dried blood in soils of varying moisture content show that it increases steadily with increase in moisture content, reaching a maximum at about two-thirds saturation, after which it declines somewhat; but at complete saturation it is sufficiently rapid to supply the needs of the rice plant.

A rotation of crops whereby a legume is ploughed in between the crops of rice is believed to be the best system for this cultivation.

PERMANENT IMPROVEMENTS DRAINAGE AND IRRIGATION

317 - **Eradicating Water Weeds from Irrigating Ditches.** — *Engineering Record*, Vol. 69, No. 2, p. 40. New York, January 10, 1914.

Disking canals while the water is running is reported as a successful means of eliminating growths of water weeds in the Bear River and Cache valley projects in California. An ordinary disk harrow is stripped of its seat and double trees and the tongue is cut 4 ft. in length. To this are hitched two ropes, leading to teams, one on each bank; by adjusting the length of these ropes the harrow can be run on either slope or on the bottom. This digs up the roots and the plants float down and are removed. The above canals were very foul three years ago when Mr. Whelan, the manager, introduced this system; now very few weeds are left. It is cheaper than mowing and it does not interrupt the flow of water.

MANURES AND MANURING.

318 - **The Balance of Fertilizers in the Soil.** — HOFFMANN M. Statische Untersuchungen. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 251. Berlin, 1913.

The aim of agricultural statics is to carry out a continued chemical control of the content of plant food in the soil under different rotations, or in other words, statics teach the way of establishing equilibrium between the supply and consumption of plant food in the soil. Its systematic application can be of great assistance in determining the manure requirements of

a soil. Of late years, however, opinions as to the value of statics differ very much, not only among scientists, but also among practical farmers.

In Germany the science of statics has been, and still is, advocated and practised by two eminent practical farmers: Schultz of Lupitz, first president of the section for manures of the Deutsche Landwirtschafts-Gesellschaft, and his successor Vibrans of Calvörde (1). Schultz-Lupitz unfortunately published the balance of five years only (1879-84), while the records of the Calvörde farm embrace a much longer period. Vibrans has, probably more than anybody else, shown great perseverance in the study of the economics of plant food in the soil, for part of his entries reach back to 1868 and are continued most conscientiously up to the present for some fields, especially on sandy or moor soil, so that the material he has accumulated covers a period of upwards of 40 years. These figures have been completely elaborated by the writer of this paper. With the object of verifying the opinions of Schultz and of Vibrans on the value of soil statics, he has added similar figures which he calculated on the data of records of five farms, the working of which was yearly checked by the Book-keeping Office of the Deutsche Landwirtschafts-Gesellschaft. The figures for these farms unfortunately embrace a period of only five years; 1907-12. It was not possible to establish the statical account for each field as only the totals of the crops were entered. As for the several farms, all the characteristic details that the writer could collect have been described in the text that precedes each table. The figures concerning Herr Vibrans' farm are drawn from his plant-food register.

In the case of Leguminous plants for fodder or pulse the nitrogen was not considered.

These tables afford a comprehensive view of the changes in the amount of plant food in the various fields during the course of years. One of them is reproduced in the accompanying table.

Vibrans has collected similar figures, though partly for shorter periods, for all the fields of his farm.

(1) See *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 76, Berlin, 1902. (*Ed.*).

Balance of Fertilizers on Calvörde Farm. — Field of 37·7 acres.

Year	Applied in manure			Removed		
	K_2O	P_2O_5	N	Crop	Yield	K_2O
1868	94	36	79	Potatoes	11 600	65
1869	—	36	14	Rye	1 390	34
1870	94	36	79	Potatoes	5 350	31
1871	—	36	14	Rye	1 370	34
1872	108	40	94	Potatoes	11 240	65
1873	—	45	14	Rye	1 270	31
1874	—	—	—	Clover and lupins	360	36
1875	140	88	128	Rye	1 400	34
1876	108	40	94	Potatoes	11 060	65
1877	94	47	106	Rye	1 740	45
1878	—	72	—	Peas and clover	2 490	45
1879	—	18	14	Rye	1 740	45
1880	126	43	108	Potatoes	9 460	54
1881	—	54	7	Rye	1 430	36
1882	108	13	54	Potatoes	16 400	108
1883	45	45	13	Rye	1 600	38
1884	140	47	209	Potatoes	17 800	128
1885	45	54	14	Rye	1 250	31
1886	140	47	209	Potatoes	17 800	128
1887	68	65	—	Peas	1 530	36
1888	68	65	—	Rye	1 200	32
1889	113	65	155	Mangolds	26 800	189
1890	113	32	29	Oats	2 500	59
1891	113	32	29	Rye	1 070	29
1892	234	65	79	Mangolds	28 500	202
1893	112	—	29	Oats	660	16
1894	95	36	135	Potatoes	19 300	130
1895	—	32	27	Mangold seed	1 890	40
1896	81	32	—	Rye	1 350	32
1897	135	45	180	Sugar beets	24 600	144
1898	—	32	—	Peas	1 500	36
1899	288	72	234	Potatoes	21 400	162
1900	—	27	13	Mangold seed	1 610	38
1901	72	36	27	Barley	920	22
1902	108	45	108	Potatoes	18 700	142
1903	56	36	31	Barley	1 500	58
1904	108	50	—	Rye	1 160	31
1905	83	97	29	Rye	1 600	41
1906	76	56	56	Rye	1 470	45
1907	76	54	54	Rye	1 530	47
1908	126	54	56	Rye	1 710	45
1909	81	59	40	Rye	1 430	54
1910	180	94	94	Mangolds	28 500	180
1911	72	49	61	Rye	890	22
1912	—	—	27	Rye	1 360	34
In 45 years: total	3700	2027	2743			2919
In 45 years: as dung	1906	673	1968			
In 45 years: as chemicals	1794	1354	775			
Yearly: total	82	45	61			65
Yearly: as dung	43	14	43			
Yearly: as chemicals	39	31	18			

on drained humous sandy soil. (All figures in lbs. per acre).

in crop		Year's balance			Total balance		
P_2O_5	N	K_2O	P_2O_5	N	K_2O	P_2O_5	N
25	72	+ 29	+ 11	+ 7	+ 29	+ 11	+ 7
20	38	− 34	+ 16	− 24	− 5	+ 27	− 17
11	31	+ 63	+ 25	+ 48	+ 58	+ 52	+ 31
20	38	− 34	+ 16	− 24	+ 24	+ 68	+ 7
25	72	+ 43	+ 15	+ 22	+ 67	+ 83	+ 29
18	34	− 31	+ 27	− 20	+ 36	+ 110	+ 9
18	—	− 36	− 18	—	± 0	+ 92	+ 9
20	38	+ 106	+ 68	+ 96	+ 106	+ 160	+ 99
25	72	+ 43	+ 15	+ 22	+ 149	+ 175	+ 121
27	50	+ 49	+ 20	− 56	+ 198	+ 195	+ 177
25	—	− 45	+ 47	—	+ 153	+ 242	+ 177
25	50	− 45	− 7	− 36	+ 108	+ 235	+ 141
22	61	+ 72	+ 21	+ 47	+ 180	+ 256	+ 188
20	38	− 36	+ 34	− 31	+ 144	+ 290	+ 157
40	112	± 0	− 27	− 58	+ 144	+ 263	+ 99
23	47	+ 7	+ 22	− 34	+ 151	+ 285	+ 65
34	77	+ 12	+ 13	+ 132	+ 163	+ 298	+ 197
18	36	+ 14	+ 36	− 22	+ 177	+ 334	+ 175
34	61	+ 12	+ 13	+ 148	+ 189	+ 347	+ 323
22	—	+ 32	+ 43	—	+ 221	+ 390	+ 323
20	40	+ 36	+ 45	− 40	+ 257	+ 435	+ 283
38	88	− 76	+ 27	+ 67	+ 181	+ 462	+ 350
41	81	+ 54	− 9	− 52	+ 235	+ 453	+ 298
14	31	+ 84	+ 18	− 2	+ 319	+ 471	+ 296
41	95	+ 32	+ 24	− 16	+ 351	+ 495	+ 280
9	22	+ 96	− 9	+ 7	+ 447	+ 486	+ 287
34	67	− 35	+ 2	+ 68	+ 412	+ 488	+ 355
18	45	− 40	+ 14	− 18	+ 372	+ 502	+ 337
20	—	+ 49	+ 12	—	+ 421	+ 514	+ 337
32	81	− 9	+ 13	+ 99	+ 412	+ 527	+ 436
22	—	− 36	+ 10	—	+ 376	+ 537	+ 436
43	97	+ 126	+ 29	+ 137	+ 502	+ 566	+ 574
22	45	− 38	+ 5	− 32	+ 464	+ 571	+ 541
11	27	+ 50	+ 25	± 0	+ 514	+ 596	+ 541
38	85	− 34	+ 7	+ 23	+ 480	+ 603	+ 564
32	63	− 2	+ 4	− 32	+ 478	+ 607	+ 532
18	36	+ 77	+ 32	− 36	+ 553	+ 639	+ 496
22	47	+ 42	+ 75	− 18	+ 597	+ 714	+ 478
25	50	+ 31	+ 31	+ 6	+ 628	+ 745	+ 484
27	54	+ 29	+ 27	± 0	+ 657	+ 772	+ 484
25	50	+ 81	+ 29	+ 6	+ 738	+ 801	+ 490
29	61	+ 27	+ 30	− 21	+ 765	+ 831	+ 469
49	94	± 0	+ 45	± 0	+ 765	+ 876	+ 469
13	25	+ 50	+ 36	+ 36	+ 815	+ 912	+ 505
20	58	− 34	− 20	− 31	+ 781	+ 892	+ 474
1135	2269				+ 781	+ 892	+ 474
25	50				+ 17	+ 20	+ 11

319 - **Manurial Experiments in the German Colonies** (1). — *Reichs-Kolonialamt, Düngungsversuche in dem Deutschen Kolonien*, Nos. 2, 3. II, and 4. Berlin, 1913 and 1914.

The above publications contain the results of further experiments carried out in accordance with the resolution adopted by the Reichstag in April 1911 (2).

Kamerun. — The soils in the mountainous zone — up to the present the only one under cultivation — are of volcanic origin, and therefore of high fertility. This, together with the fact that the native cultivators had never carried on an intensive form of culture, led to the belief that the soils were inexhaustible, which is far from being the case. In fact the high rainfall (10 000-12 000 mm., or 390-470 in.) subjects the soil to serious leaching, which is only partly counterbalanced by the considerable absorbent power of the soils for nutrient materials.

Analyses of the soil do not indicate an especially high nutrient content, which remains within the following limits (per cent.):

Nitrogen	Potash.	Phos. acid.	Lime	Magnesia
0.15–0.22	0.05–0.12	0.04–0.145	0.063–0.156	0.08–0.27

Existing plantations cover 70 000 acres, of which 50 000 acres are rubber underplanted with cacao and the rest oil palms.

Nitrogenous manures are hardly needed, as the rapid decomposition of organic matter and the tropical rains, as well as the absorbent power of the soils, tend to maintain the reserves of nitrogen. Potash is required in large dressings, for not only are the soils poor in this substance but the two crops, cacao and palms, remove considerable amounts in the beans and nuts (1.3 per cent. and 0.5 per cent. of potash respectively). The same may be said for phosphoric acid. Lime is especially necessary in tropical agriculture, but must be used with considerable caution as it may otherwise lead to soil exhaustion, and in this connection it may be mentioned that the Kamerun soils, being specially rich in magnesia, should provide good material for investigating the question of Loew's lime-magnesia ratio. Humus is usually deficient in tropical soils and should be increased by the use of all crop refuse and by green manuring.

Fertilizers are beginning to be appreciated by planters, and the imports rose from 22 tons in 1907 to 1450 tons in 1912.

In order to establish a rational system of manuring, the Agricultural Experimental Institute at Victoria has organised a series of manurial trials based on the system adopted by the German Agricultural Society, and modified according to local requirements. Thirty-two series were running in 1911-12 and these were increased to 47 in 1913, embracing the following crops: cacao, Funtumia, Hevea, manihot, oil palm, bananas, tobacco, maize, cotton, earthnuts, sweet potatoes, pine apples.

Togo. — Agriculture being chiefly in the hands of native cultivators, manurial trials have been carried on in their plantations in the hope of

(1) See No. 480, *B.* May 1913; No. 1250, *B.* Nov. 1913; No. 11, *B.* Jan. 1914. (*Ed.*)
(2) See No. 480, *B.* May 1913. (*Ed.*)

eventually inducing them to use fertilizers; other trials have been carried on too at the Government stations and on private plantations. In 1913, sixty series of trials were running, distributed over the following crops: cotton, maize, sisal, cocoanut, oil palm, cacao, coffee, rubber, kola, sweet potatoes, beans, sorghum, vegetables.

In an appendix the general plan of the experiments is given. Each series consists of five plots receiving so-called "differential" treatment, and is carried out in duplicate. Particulars are also given of the dressings applied to the principal crops, of the area of the plots, and of their treatment.

German East Africa. — From the results of the experiments begun in 1911 (1) it would appear that the application of fertilizers has a good effect on the crops obtained, but more data are required to confirm these results. The plan originally laid down for the experiments has proved very satisfactory and has not required to be modified in any way, but a larger staff is urgently required in order to carry on the work more effectually.

German New Guinea. — Notwithstanding their origin from recent volcanic material, the soils exhibit a relatively low potash content, from which it would appear that there must exist a factor impoverishing the soils in this respect; phosphoric acid is high and nitrogen rather low. In 1912 there were 80 000 acres under cultivation in the Protectorate (including the islands); of this area, 73 000 acres were under coconuts, 26 700 acres being in bearing. Other plantations consist of rubber and cacao, and the starch-producing plants of the natives, the latter being very exhausting crops. Coconuts too, remove large quantities of mineral matter from the soil: with 40 palms to the acre, an annual production of 2400 coconuts per acre would remove:

potash	71 lbs.
nitrogen	11 »
phosphoric acid	6 »
lime	6 »
magnesia	4 »

Up to the present manuring has been confined to the application of dung or to green manuring with *Crotalaria striata*, *Tephrosia purpurea* or other Leguminous plants, but more complete manuring is necessary not only for increasing the crops but also for making them more resistant to desease. The extended use of fertilizers will, however, be impeded by the high cost of transport.

The Government started 32 series of trials in 1912-13 and increased them to 35 for the season 1913-14, distributed over the following crops: coconuts, rubber, cacao, coffee, bananas, maize, sorghum, sweet potatoes, manioc, earthnuts, castor oil, *Paspalum dilatatum*, pineapples and vege-

(1) See No. 480 *B.* May 1913. (*Ed*).

tables. The experiments were carried out on the same lines as those mentioned above in connection with Togo.

Samoa. — The soils are of variable fertility, notwithstanding their common basaltic origin, and, according to the analyses of Woltmann, possess a high content of nitrogen, phosphoric acid, magnesia and iron and a moderate to low content of lime, but are deficient in potash.

Twenty-three series of manurial trials were started in 1912-13 and increased to 32 the next season; they deal with the following crops: cacao, coconuts, rubber, taro, lucerne, pasture, bananas, maize, tobacco, pineapples, vegetables.

The first experimental results obtained with taro (*Colocasia antiquorum*) are of special interest, as it is the chief native crop and the principal article of diet of the Samoans. Being an exhausting crop the native practice is to move on to a fresh piece of ground when the soil is worn out. With the usual manurial dressings, it was found that, though the experimental plots had previously been under cacao, crops of tubers were obtained equal to those on virgin land. Moreover the formation of new tubers was greatly stimulated, and the number of new shoots formed averaged ten per plant or twice the usual number, so that not only was the harvest larger but the means of propagation were also increased. The new tubers were almost as large as the mature tubers, which is not usually the case, and their shoots were so well developed that they could be transplanted without experiencing a set back. The new tubers being more abundant, five could be left in the soil in the place of the usual two, and thus the crop was increased.

An appendix to this report contains detailed instructions for carrying out the experiments as well as the arrangement of a book for recording results.

320 – **The Influence of Catalytic Substances on Crop Yields.** — RIVIÈRE, G. and BAILHACHE, G. in *Journal de la Société Nationale d'Horticulture de France*, Vol. XIV, pp. 782-788. Paris, December 1913.

In 1906, applications of ammonium vanadate, sodium borate, sodium fluorate, and sodium arsenate increased cereal crops 10 per cent., while salts of lithium, caesium and rubidium had a still greater effect on a beet crop. During the next three years, rubidium salts alone were tested, and in two out of the three years marked increases in the yields were obtained. The soil on which the experiments were carried out was a loam resting on clay.

321 – **Phosphate Beds in Egypt.** (1) (Note sur l'industrie minière en Egypte, rédigée par le Département des Mines-Phosphates). — EGYPTE, MINISTÈRE DES FINANCES, *Annuaire Statistique de l'Egypte*, Year V, p. 583. Cairo, 1913.

The Egyptian phosphate beds are very similar to those of Tunis and Algeria, being widely distributed and forming altogether a very large area. They have been comparatively little investigated. As they are situated

(1) See No. 1246, *B.* Nov. 1913.

a long way from the Mediterranean coast, those nearest to the other transport routes were the first to attract attention, and the ones being worked at present are near either the Red Sea or the Nile Valley. These too, according to the available evidence, are the richest, and compare favourably with Tunisian and Algerian varieties. It is thought that it will be possible to increase the production of the richer salts containing 68 per cent. or more of tricalcic phosphate and that the material will be exported to Europe. The entire production of the "Egyptian Phosphate Co." for 1912 (60 000 tons) was sent to Japan; this company works three mines near Safaja Bay (Red Sea), where modern appliances have been erected for loading, and a light railway has been laid to connect the mines with the port. The "Società Egiziana per l'Estrazione ed il Commercio dei Fosfati" is also working large areas at El-Kosseir on the Red Sea and at Sebaia on the Nile and is erecting plant for export work.

Should the demand for phosphates be maintained, as there is every reason to suppose from their increasing use, the future of the Egyptian industry is very promising.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

322 - **Influence of Radio-active Emanations on Vegetation.** — STOKLASA, J. and ZDOBNICKY, V. in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 22, pp. 1082-1084. Paris, December 1, 1913.

1. — *Cultures in Knop's solution containing radio-active water either artificial or natural.*

The experiments were conducted at Franzensbad and Brambach near the sources of the natural waters. The Brambach waters possess a strength of 2200 Mach units per litre, and those of Franzensbad about 100 to 150 units. Each culture was supplied with 70 Mach units of radio-activity in its nutritive solution. After two days, the activity of the solution had been reduced to 52 units, after three days to 36 units, while after four days it fell to only 19 units and had to be renewed. During the 23 days of the experiment, each plant had received 350 units of radio-activity.

After 23 days at a temperature of 18° to 20° C. the following results of the dry weight of the plants were obtained:

	Control	Radio-active
	—	—
Lentils	3.7 grams	6 grams
Peas	9.7 »	21 »
Wheat	3.1 »	8 »

Thus the radio-active water has increased the yields by from 62 to 164 per cent.

The following results were obtained with buckwheat grown in soil for 52 days and supplied with solutions containing 30 and 60 units of radioactivity every five days:

	Dry weight of 100 plants
	—
Control	9.45 gms.
With 30 units	13.54 »
With 60 units	19.54 »

When the radio-activity was increased by giving 600 units every four days, the growth of the plants was checked.

2. — *Pot cultures sprayed with artificial radio-active water.*

Experiments with poppies (35 plants) receiving a total of 2500 units of radio-activity during a period of 108 days, gave the following results:

	Dry matter		
	fruits	stems	total
With radio activity	35.33 gms.	83.58 gms.	118.91 gms.
Control	16.25 »	63.08 »	79.33 »
Increase due to radio-activity	19.08 » or 117.4 %	20.50 » or 32.4 %	39.58 »

Lupins (48 plants) sprayed with water containing a total of 2000 units gave the following results:

	Dry matter		
	seeds.	stems.	total
With radio-activity	224.91 gms.	451.25 gms.	676.16 gms.
Control	136.58 »	284.16 »	420.74 »
Increase due to radio-activity	88.33 » 65 %	167.09 » 59 %.	255.42 »

Thus spraying the plants with radio-active water increases the fertility and the rate of maturity of the plants.

3. — *Pot cultures subjeted to radio-active emanations in closed vessels of 85 litres capacity.*

Experiments with field peas, maize, buckwheat, white mustard and beets, grown in air charged with from 10 to 30 Mach units per litre, showed earlier flowering and more rapid maturity and increases in yield of from 30 to 90 per cent over those of the control plants.

Large doses of radio-active emanations retard growth and appear to give rise to toxic products.

PLANT BREEDING.

323 – **Royal Hungarian Institute for Plant Breeding.** – *Communication from* M. EMILE GRABNER, *Chief of the Institute.*

The improvement of agricultural plants in Hungary has been practised for a considerable time, but owing to the faulty system followed, positive results have ouly been obtained during the last 10 years by the adoption of systematic selection. Owing to the continental climate, it is not possible to acclimatise the most important varieties of crops (especially wheat) produced in Western Europe, and it therefore becomes more necessary in the interests of intensive culture to adopt measures for the improvement of local varieties. Various isolated attempts had already been made in this direction, and the necessity for coordination called for the creation of a State Station to render assistance to workers by means of professional advice, to reorganise and develop the methods of improvement and to take up the improvement of the more important plants not selected by the agriculturists.

With this object in view, the Ministry of Agriculture established the Royal Hungarian Institute for Plant Breeding. The work of organisation was begun in the spring of 1909 at Budapest and continued the following year at Magyaróvár, where the station was finally set up at a cost of £13 300 for the land and buildings and £ 3 300 for equipment. The garden covers nearly 2 acres and is close to the central building containing the offices and laboratories. There is also a glass culture house for tender plants, 200 portable culture pots and 140 pots sunk in the ground. The garden is used for the more valuable culture material under investigation, such as the first year's selection and hybrids. About 15 minutes' walk from the town, there are about 50 acres of experimental fields for the trial of selected seeds and the multiplication of desired strains for adoption on a large scale. There is also a building containing a museum for the classification of products, a seed depôt and rooms for the overseer. The staff of the Institute includes the chief, 4 assistants, 1 chemist and 1 clerk, under the direct charge of the Ministry of Agriculture.

Some idea of the recent work of the Institute can be obtained from the following figures showing the material under investigation:

Wheat	3708 plots	883 plots of pedigree wheat from workers in different parts of the country.
		1758 plots of F_3 generations.
		128 » » F_2 »
		256 » » F_1 »
		683 » for the trial of foreign varieties

Rye	1997	plots selected from different varieties.
Barley	179	» of selected strains.
Oats	620	»
Maize	75	»
Potatoes	410	» of hybrids.
Lucerne and clover .	2263	» of selected strains.

By means of gratuitous advice to practical agriculturists on the carrying out of selection methods and local selection experiments, the Institute is organised so as to meet the requirements of the different districts by producing varieties adapted to the various climatic and soil conditions. The best types thus obtained by practical workers are tested in the experimental fields of the Institute, subjected to rigorous investigation and finally used for hybridisation work. This intimate collaboration with the practical agriculturists in the different districts promotes the success of the work of the Institute and the adoption of its methods throughout the country. Questions affecting the theory of selection and the improvement of plants (clover and lucerne) not undertaken by the practical agriculturists are under investigation in the experimental fields of the Institute, and any results obtained will be immediately adapted to the climatic conditions of the different districts.

The work of the Institute may be summarised as follows: 1) extending its sphere of activity thoroughout the entire country and securing the adoption of its methods by the practical agriculturists; 2) directing local work among the agriculturists; 3) researches on the theory of selection; 4) making known the principles of selection by means of publications and lectures; 5) selection of plants not undertaken by practical agriculturists.

Tobacco, flax and hemp are not included in the programme of the Institute, a separate experimental station being devoted to each of them. The selection work is chiefly concerned with the chief crop plants. The accompanying list gives the distribution of the different crops in percentages of the total cultivated area (excluding Croatia-Slavonia), which has varied during the last five years between 31 and 32 million acres.

Wheat, autumn	27.49	to	30.45
» spring	0.88	»	1.07
Maize	20.42	»	21.71
Oats	9.15	»	9.56
Barley, spring	8.72	»	9.63
» autumn	0.48	»	0.58
Rye, autumn	8.61	»	9.20
» spring	0.17	»	0.24
Potatoes	4.97	»	5.28
Lucerne, clover	4.49	»	4.98
Mixture of vetches, moha (*Panicum germanicum*) and other forage plants	3.78	»	4.16
Sugar-beets	0.90	»	0.99
Mangels	1.62	»	1.73
Other plants (e. g. sorghum)	1.08	»	1.15
Maize (forage)	0.78	»	0.89
Meslin (wheat and rye)	0.48	»	0.62
Hemp	0.46	»	0.49
Flax	0.07	»	0.11
Tabacco	0.42	»	0.44
Vetches	0.37	»	0.41
Pulse (peas, lentils, beans)	0.25	»	0.28
Colza	0.14	»	0.24
Millet	0.18	»	0.25
Buckwheat	0.03	»	0.05

The Institute occupies itself, in the first place, with the different cereals, potatoes, sugar-beets, mangels, lucerne and clover, and only undertakes the improvement of other crops when their development requires it. Owing to its very recent organisation it is not able to show results in all tbe branches of its activity. Several years before the creation of the Institute the present chief began operations in the selection of wheat, which have been continued now for eight years in various districts. As a result of this selection we have already obtained selected strains of wheat derived from common Hungarian wheat by rational methods of selection, which have given increased yields of 7 ½ to 9 bushels per acre in the field trials

during the last three years. The experiments on the selection of other plants, though at present in the early stages, give promise of equally good result, and we have reason to expect that the Institute will realise in the near future the task which it has undertaken, *i. e.* to increase the productiveness of the country by the creation of more productive varieties suitable to the climate and soil conditions. In direct relation to the practical problems, scientific reseaches concerning the reorganisation and development of the methods of selection are in course of progress, and good results are expected from them.

324 - **Studies on Variation and Selection.** — HAGEDOORN, A. L. and Mrs. A. C. in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. II, No. 3, pp. 145-183 + 4 figs. Berlin, January 1914.

This is a survey of the progress made in the Mendelian interpretation of variation and selection. The difficulties of the present terminology are pointed out and a plea is made for more precise definition and use of terms. The criticisms of the zoologists are analysed and answered by results from the writers' own experiments.

325 - **The Preservation of Pollen.** — ROEMER, TH. in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, pp. 83-86. Berlin, January 1913.

The writer has established by experiments that the pollen used for artificial fertilization preserves its power of germination best when kept at a low temperature and in the driest air.

326 - **Variation in the Hereditary Value of Characters in Individual Flowers of *Pisum sativum*.** — ZEDERBAUER E. In *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, pp. 1-26. Berlin, January 1914.

The writer had for some years observed that in the splitting up of the seed-characters in the F_2 generation of crosses of certain peas, there was a difference according to the position on the plants, as for instance that the lowest pods gave yellow seeds, while green ones began to appear in the middle pods and were more numerous in the highest ones. This led him to make a careful examination of the results obtained by crossing the flowers occurring in different positions on the plants.

The parents used were Wunder von Amerika (green wrinkled seeds) and Auslös de Grâce (yellow smooth seeds); these varieties agree in being 8 to 12 inches high and in bearing the first flower in the axil of the seventh or eighth leaf. For these varieties the 1st and 2nd flowers are reckoned as early, the 3rd to 4th or 5th as middle and the remaineder as late.

Crosses between flowers of the same period (*e. g.* early × early) are called *isochronous*, and those between flowers of different periods (*e. g.* early × late) *heterochronous*.

Table I gives a summary of the results (F_1 generation seeds) from the crossing of a large number of flowers on ten plants, in which the female parent (M) was Wunder von Amerika and the male parent (P) Auslös de Grâce: the yellow and smooth characters of the latter are dominant. On every plant one or more flowers were selfed as a test of purity and all gave unmixed wrinkled green seeds.

TABLE I.

M No. of flower	P No. of flower	yellow	yellow, tinged green	yellowish green	green	smooth	slightly wrinkled	wrinkled
				a) isochronous crosses.				
1	1	—	—	8	16	8	—	16
2	2	—	1	15	1	16	—	1
3	3	—	—	12	1	12	—	1
4	4	—	3	12	1	11	4	1
5	5	—	1	—	1	1	—	1
Total per cent.		—	7	65	28	67	5	28
				b) heterochronous crosses.				
				1) middle M by early P.				
3	1	—	4	1	—	5	—	—
2	1	—	1	1	2	2	—	2
Total per cent.		—	56	22	22	78	—	22
				2) late M by early P.				
5	1	—	11	4	—	14	1	—
6	1	—	7	1	—	5	3	—
6	2	2	1	1	—	2	2	—
7	1	1	2	—	—	—	3	—
Total per cent.		10	70	20	—	70	30	—
				3) early P by M of various ages (in per cent.).				
1	1	—	—	33	67	33	—	67
2	1	—	—	80	20	70	10	20
3	1	—	80	20	—	100	—	—
4	1	—	25	25	50	50	—	50
5	1	—	73	27	—	93	7	—
6	1	—	86	14	—	63	37	—
7	1	33	67	—	—	—	100	—

A second series was carried out with the reciprocal cross. Here the isochronous crosses gave 16 per cent. yellow, 52 per cent. yellow tinged with green and 32 per cent. yellowish green (no green), and 100 per cent. smooth; heterochronous crosses gave for M1 × P6, 19 per cent. yellow and 81 per cent. yellow tinged with green, and for M6 × P1, 100 per cent. yellowish green.

In discussing these results, the writer suggests using the term "valency" for the power of transmission of a character: thus dominant becomes prevalent and recessive sub-valent, while equi-valent is used for cases in which

the F_1, characters are intermediate; these terms refer to valency in space Räumliche Wertigkeit). The valency is modified by the period of opening of the flower: thus the early flowers have high valency the middle ones moderate valency, and the late ones low valency, these terms referring to valency in time (Zeitliche Wertigkeit). The valency of the character further varies with the sex to which it is attached, being higher in the female.

A hypothetical scheme may be drawn up for the valency (Wertigkeit) of the different characters in the flowers of the different periods (when yellow is associated with the female parent):

Valency of yellow, (M) in . .	early flowers (I)	24
	middle » (II)	18
	late » (III)	12
Valency of green (P) in . . .	early flowers (I)	20
	middle » (II)	15
	late » (III)	10

Thus M (II) 18 × P (I) 20 will give preponderance of P, M (II) 18 × P (II) 15 preponderance of M, and M (II) 18 × P (III) 10 preponderance of M (probably unmixed M).

In the case of smooth and wrinkled, the valency of the former character appears to be **higher** relatively to the latter (*e. g.* 35 : 20) than in the colour pair (24 : 20), as it is not till **M** (III) × P (I) that mixing occurs (where smooth is associated with the female parent).

327 – **On Differential Mortality with respect to Seed Weight occurring in Field Cultures of *Pisum sativum*.** — HARRIS, J. A. in *The American Naturalist*, Vol. XLVIII, No. 566, pp. 83-86. New York, February 1914.

It has previously been shown (1) that the mortality of seeds of *Phaseolus vulgaris* before germination is not random but differential or selective.

In these experiments with *Pisum sativum*, about 1000 seeds from each of ten commercial early (dwarf) varieties were weighed, individually labelled and planted in short rows in the experimental field. The weight distributions were based on differences of 0.025 gram, and the mean weights and coefficients of variability were calculated from the variates thus obtained. When the plants had grown about 3 in. high, counts were made of the seeds which had failed to germinate.

In seven varieties it was found that the mean weight of the seeds which had germinated was greater than the mean of the ungerminated seeds. In the remaining three varieties the mean weight was greater in the ungerminated seeds, the differences between the means being 2.2, 3.9 and 5.5 times their probable errors respectively. In at least one case, therefore, there is a tendency for the lighter seeds to show a viability greater than that of the heavier seeds.

Comparison of the standard deviations and coefficients of variability of the ten varieties shows that the variation of seed weight is less in the seeds of greater viability in 7 cases, but these are not the same varieties in which the mean weight was greater.

These results are therefore in agreement with those obtained in the case of *Phaseolus*.

(1) See No. 110, *B*. Feb. 1914. (*Ed.*).

328 - A Genetic Analysis of the Changes produced by Selection in Experiments with Tobacco. — EAST, E. M. and HAYES, H. K. in *The American Naturalist*, Vol XLVIII No. 565, pp. 5-48 + 9 figs. New York, January 1914.

These experiments were designed with a view to testing the theory of Johannsen regarding the finality of selection of pure lines, and to show that the changes which follow the continuous selection of extremes under certain conditions are to be interpreted entirely by the segregation and recombination of hypothetical gametic factors which are constant in their reactions under identical conditions.

Nicotiana tabacum was chosen as being easily grown, naturally self-fertilised, and prolific in seed production, that is to say ideal for the purpose. Number of leaves was the character studied, since it is unaffected by environment (except during the critical period of development in the embryo). The parental cross was made between the Havana variety having a range of 16 to 25 leaves and an average of 20, and the Sumatra variety with a range of 21 to 32 leaves and an average of 26. The results of this cross are set out below:

	Sumatra ×	Havana
No. of leaves	21 – 32	16 – 25
Coeff. of variability	6.64 ± 0.27%	6.98 ± 0.27 %
	F_1	
No. of leaves (average)	23.3 ± 0.14 %	
Coeff. de variability	6.24 ± 0.41 %	
	F_2	
No. of leaves	18 – 31	
Coeff. de variability	10.29 ± 0.23 %	

Thus the F_1 generation is intermediate between the parents and has practically the same coefficient of variability. The F_2 generation was extremely variable and included both the parental types. Some combined the leaf size and habit of growth of the Havana parent with the leaf number of the Sumatra parent, and therefore resembled the type obtained by Shamel in 1906 in the F_3 generation of the reciprocal cross between these two varieties. This hybrid, known as Halladay, had 26 small round-pointed leaves with short internodes, and was supposed to be a mutation. In 1908 100 seed plants of this hybrid were selfed, and produced the material used in these selection experiments. Accurate observations of the progeny of these F_3 and F_4 plants showed that their homozygosity was only apparent. The general type of the plants appeared to be constant, but the frequency distribution for number of leaves was not the same in the F_5 and F_6 populations.

Selection was made of the extremes in these generations with the following results:

Generation	No. of leaves of parent	Range of no. of leaves	Mean	Mode
F_4	—	—	—	25
F_5	—	—	—	23
F_6	23	20 to 27	22.4 ± 0.11	22
F_7	20	17 to 28	21.9 ± 0.08	21
	27	20 to 32	24.9 ± 0.11	25
F_8	20	18 to 26	21.3 ± 0.05	21
	30	22 to 33	26.6 ± 0.07	26
F_9	20	14 to 25	18.4 ± 0.07	18

The extremes selected for the parent plants were not members of the most extreme classes, yet selection of the minus variants reduced the mode from 23 to 18 and selection of the plus variants raised the mode from 23 to 26.

In a duplicate set of experiments at New Haven, Connecticut, selection of the minus variants reduced the mode in three generations from 23 to 21 and the plus selections increased the mode to 28. In the F_9 generation there was a difference of 9 between the means of the two strains.

The results of selection in other strains did not give such regular changes in the modes of each generation, and, in some of them selection produced no change at all. This is what would be expected in strains of different degrees of heterozygosity.

In one particular strain, selection of the minus variants produced practically no change in the mode in three sets of experiments, while selection of the plus variants raised the mean to 30.7, 29.6, 30.8 in the three corresponding plus strains. In these experiments at Bloomfield, the F_8 generation from the plus extreme showed a remarkable range of variation, from 18 to 36.

In another strain, selection of both extremes resulted in a slight increase in the mean during three generations, and, in the F_7 generation of the plus strain having a mean of 25.7 ± 0.09, a 12-leaved plant appeared. An individual with 12 leave shad never been observed before, though thousands of plants have been examined. The distribution of plants in this generation was as follows :

No. of leaves	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Frequency	—	—	1	—	—	—	—	—	—	—	1	1	4	24	36	42	44	41	21	13	7	—	—	—

This 12-leaved plant was selfed and gave rise to a population giving the following analysis.

Generation	No. of leaves of parent	Range of no. of leaves	Mean
F_6	28 (12)	20 to 30	25.7 ± 0.09
F_7	12	8 to 30	19.8 ± 0.28
F_8	10	11 to 27	17.9 ± 0.08

Evidently a mutation occurred in the F_6 generation and this mutant did not breed true as in the case of those of De Vries.

Conclusions.

The results show that the Halladay hybrid originated in the segregation and recombination of the characters of the parents (Havana and Sumatra) and not as a mutation. The fact that strains were obtained from this hybrid with a greater mean number of leaves than even the Sumatra parent shows that the difference between the parent varieties in leaf number is greater factorially than somatically. The original hybrid, which was supposed to breed true, gave rise to plus and minus strains showing progressive changes on selection, and also to strains which showed no change and appeared to breed true to type; but it is not possible to say that any of the strains are so fixed that no progress could be made by selection. Should a sufficient number of hybrids be obtained, so as to include a perfectly homozygous strain, such type would be found constant for all practical purposes. It may be, however, that long-continued experiment with enormous numbers will show some slight shifting of the mean, and that this may be due to the slow progress of evolution. Such changes could hardly be determined experimentally beyond reasonable doubt.

Mutations may occur due to constitutional changes in a single germ cell, and they therefore appear as F_1 generations giving rise to several new strains requiring selection. Since mutations are not of very frequent occurrence in any particular strain, it is only the comparatively large jumps that are economically important, and these are easily detected without refined methods of procedure. It therefore seems unwise for the practical breeder to expend time and money in obtaining results that are so slow and so trifling that they cannot be detected in carefully planned and accurately executed genetic investigations. The only financially profitable procedure is the isolation of homozygous strains from mixtures of either a mechanical or physiological nature.

Advantage should also be taken of the fluctuating variability which takes place during the critical period of seed formation. Seed from well-developed mother plants will produce plants with a slightly higher leaf number than seed from plants grown under poor conditions .The disturbance due to transplanting, though not affecting the number of leaves produced, affects their development and maturation, and should therefore not be delayed too long.

329 - **Cereals Indigenous to Mongolia**. — PALIBINE, J. W. in *Annalen der Samenprüfungsanstalt am Kaiserlichen Botanischen Garten Peters des Grossen*, Vol. II, No. 1, pp. 1-12 + figs. (summary in French, pp. 13-16). St. Petersbourg, 1914. CEREAL AND PULSE CROPS.

The travels of Mlle. K. W. Jourganoff in N. E. Mongolia during the autumn of 1911 have resulted in the re-discovery of two psammophytic cereals known locally as " khar-soul " and " tsagan-soul " respectively and much appreciated by the Mongols as a source of food.

1. Khar-soul — *Arundo villosa* Trin. (*Calamagrostis villosa* herb. de Trinius) ; *Psamma villosa* Maxim. This was discovered by Prof. Bunge in 1831 and has not yet been entered in the " Index Kewensis " . Specimens exist in the herbarium of the Imperial Botanic Garden of Peter the Great at St. Petersburg, and in the herbarium of G. Potanine. The plant has a horizontal sympodial rhizome producing a series of upright shoots, and is adapted for binding sand dunes. The grains are long and oval in shape with a black pigmented pericarp ; the starch grains are compound like those of oats. Each ear is harvested separately by means of a knife, and the Mongols, who travel on camels, may collect 150 to 180 lbs. of grain each during the season.

2. Tsagan-soul—*Elymus giganteus*, Vahl.; *E. arenarius* L., var. *giganteus* Schmalh. This plant is very similar to *E. arenarius*, but larger in all its dimensions. It occurs in the steppes and sandy places in the south of Russia, near the Caspian sea, in Orenburg and north of the Caucasus, as well as in Turkestan, on the Tian-Schan and in Siberia. The grain is white in colour and is much preferred to khar-soul by the Mongols. The grain of *E. arenarius* L. used to be used for flour in Western Europe in times of scarcity, and is still regularly collected in Iceland, but this grain is much smaller than that of *E. giganteus* Vahl.

These cereals, being adapted to climates with very low rainfall and for binding waste sand dunes, should be of considerable interest for experiment in many parts of the world.

330 - **Contributions to the Question of the Frost-Resistance of Cereals.** — GASSNER, G. and GRIMME, C. IN *Berichte der Deutschen Botanischen Gesellschaft*, Vol. XXXI, Part 8, pp. 507-516. Berlin, 1913.

To extend the work of other investigators, experiments were carried out with grains from very even samples of Petkused winter and spring rye, germinated at 5-6° and at 28° C.; the first leaves were analysed for sugar. Table I gives the results in percentage of dry matter.

Thus the seedlings which had germinated at the lower temperature (and were therefore more frost-resistant) were readily distinguishable from those which had germinated at the higher temperature by their higher sugar-content ; at the same time seedlings of the hardy Petkuser winter rye show a higher sugar-content than those of Petkuser spring rye grown under the same conditions.

Experiments with barley gave corresponding data.

These results indicate that with cereals also the sugar-content has an influence on resistance to cold.

TABLE I.

Series	Germination temperature 5-6°			Germination temperature 28°		
	Total sugar	Reducing sugar	Non-reducing sugar	Total sugar	Reducing sugar	Non-reducing sugar
			Petkuser winter rye			
I	42.19	34.93	7.26	40.92	32.56	8.36
II	43.14	35.86	7.28	39.79	31.14	8.65
III	41.92	34.84	7.08	39.13	31.08	8.05
IV	42.31	35.85	6.46	40.73	33.94	6.79
V	40.97	32.31	8.66	39.52	34.11	5.41
			Petkuser spring rye.			
I	36.58	29.41	7.17	31.57	27.13	4.44
II	37.08	30.57	6.51	33.26	26.58	4.68
III	35.39	30.41	4.98	32.59	26.81	5.78
IV	37.65	31.02	6.63	34.56	30.38	4.18
V	35.85	30.21	5.64	32.94	28.16	4.78

Further experiments, which it was not possible to complete, show that the slighter differences in hardiness among individual varieties of winter grain correspond to slight differences in the sugar-content.

331 – **Environmental Influences on the Physical and Chemical Characteristics of Wheat.** — LE CLERC, J. A. and YODER, P. A. in *The Journal of Agricultural Research*, Vol. I, No. 4, pp. 275-291. Washington, D. C., January 1914.

This paper is a continuation of previous work showing that the composition and physical characteristics of wheat are not to any great extent hereditary.

To distinguish between the effects of the soil and those of climate, samples of soil 5 feet square and 3 feet deep were interchanged among three localities, in Maryland, Kansas and California respectively, possessing widely different climatic conditions.

Four plots were arranged at each station as follows:

1 plot of undisturbed local soil as control.
1 plot of local soil . . . . } taken up in layers of 3 inches to a depth of three feet and replaced in original order.
2 plots of imported soil, one from each station. }

During 1908 and 1909 Crimean wheat from Kansas was grown on all 12 plots, but as it was found to be unsuitable to the conditions prevailing in Maryland and California, it was replaced by Turkey wheat in 1910, 1911 and 1912.

TABLE I.

Determination	Averages of the three soils		
	California	Kansas	Maryland
Physical properties:			
Water . . . . per cent.	8.98	9.53	9.53
Weight per 1000 grains . . . . . grams.	30.2	19.1	25.6
Weight per bushel . . . . lbs.	62.8	57.2	60.1
Flinty grains . . . . per cent.	86	99	35
Chemical analysis on water-free basis:			
Nitrogen . . . . per cent.	2.42	3.30	2.18
Protein (N × 5.7) . . . . »	13.11	18.83	12.43
Alcohol-soluble nitrogen . . . . . »	0.92	1.27	0.90
Gliadin in protein . . . . »	41	42	40
Fat . . . . »	1.97	2.	1.94
Fiber. . . . . »	2.34	2.89	2.63
Pentosans . . . . »	8.45	8.76	8.56
Sugars. . . . . »	3.61	3.32	3.03
Ash . . . . »	1.60	2.30	2.22
Phosphoric acid . . . . »	0.90	1.02	1.18
Potash . . . . »	0.57	0.68	0.67
Phosphoric acid in ash . . . . . »	47	45	53
Potash in ash . . . . »	29	30	30

The following determinations were made according to the revised methods of the Bureau of Chemistry :

Water; weight of 1000 grains; weight of a bushel; flinty grains; nitrogen; alcohol-soluble nitrogen; fat; fibre; pentosans; sugars; ash; phosphoric acid; and potash.

The results obtained are summarised in Tables I and II. In Table I they are arranged as averages of the three soils for each district and show the difference due to climatic influence. In Table II they are arranged as averages of the three districts and show the effect of soil conditions.

The results of the undisturbed control plots showed that the disturbance of the soil had not effected the constitution of the plants.

A comparison of the results in Tables I and II shows that only the climatic conditions have any considerable influence upon the properties and composition of the crop.

Considering weight of grain, the figures for weight per 1000 grains show considerable difference in Table II, showing the effect of soil conditions; but these differences are much smaller than those in Table I, showing that the

TABLE II.

Determination		Averages of the three districts		
		California Soil	Kansas Soil	Maryland Soil
Physical properties:				
Water	per cent.	9.35	9.46	9.29
Weight per 1000 grains	grams.	26.5	27.9	22.1
Weight per bushel	lbs.	60.9	60.4	—
Flinty grains	per cent.	71	69	85
Chemical analysis on water-free basis:				
Nitrogen	per cent.	2.48	2.52	2.75
Protein (N × 5.7)	»	13.88	13.94	15.44
Alchol-soluble nitrogen	»	1.	0.94	1.05
Gliadin in protein	»	42	41	40
Fat	»	1.93	1.98	1.97
Fiber	»	2.55	2.59	2.73
Pentosans	»	8.41	8.48	8.87
Sugars	»	3.33	3.48	3.30
Ash	»	2.13	2.08	2.16
Phosphoric acid	»	1.04	1.03	1.05
Potash	»	0.64	0.61	0.66
Phosphoric acid in ash	»	48	48	48
Potash in ash	»	30	29	29

climatic effect is much greater than that due to the soil. Similarly, the figures for the flintiness of grain show more variation due to climate than to soil.

With regard to the chemical constituents, the figures for the determinations of nitrogen, protein, ash and phosphoric acid show a much greater variation due to changes of climate than to changes in the soil. Little or no regular variation occurs in the proportions of gliadin, potash in the ash, fat, fibre, pentosans and sugars.

The writer suggests the following possibilities as to the manner in which the climatic factors exert a determining influence on the composition of the wheat crop:

1) Differences in humidity may cause a difference in the transpiration of the plant, which in turn may react on the composition of the crop.

2) Variations in the amount and distribution of sunlight may influence diversely the photosynthesis of the plants.

3) Differences in temperatures and in the succession of hot and cold periods may cause varying vegetative activities in the plants.

4) The climatic differences, such as humidity, rainfall, temperature and sunlight, may bring about changes in the physical chemical, or biological characteristics of the soil, which in turn may react on the crop.

Thus it may not be impossible for soil which has been transferred from one locality to another, to become so changed by climatic environment that the character of the wheat grown thereon would be approximately the same as that grown in soil belonging to the locality.

The great difference between the protein of the Kansas and the Maryland crops cannot be attributed to the greater nitrification in the Maryland soil when transferred to Kansas, since applications of nitrate as fertiliser produce only a slight increase in the protein content of the crop.

The writers consider that these results confirm the conclusion of previous work (1) that environment (climate in particular) rather than heredity is the major factor in determining the physical and chemical characteristics of the wheat crop.

332 – **Some Characteristics of the Endosperm of Chevallier and Goldthorpe Barleys.** — VINE, H. C. A. in *The Journal of the Institute of Brewing*, Vol. XX, No. 1, pp. 23-33 + 2 figs. London, January 1914.

Microscopic examination was made of several verified specimens o. Chevallier and Goldthorpe barleys with a view to determining any specific differences in the characters of their starch granules. The author observes that the starch grains from barley, unlike those of the potato which can easily be disintegrated, remain intact after long grinding with the hardest glass, showing that they possess elasticity and resiliency.

In the Goldthorpe varieties the round form of granule predominates, while in the Chevallier varieties the oval form is the general feature. This difference in shape of the grains is only well marked in pedigree strains, and cannot be used to distinguish commercial varieties with reliable results. The ratio of large and small granules is a much more definite criterion, and may prove to be useful in indicating the extent to which any given sample has varied from the true stock. Counts of the numbers of starch granules of different sizes gave the following results :

Size of granules in inches		Percentages of granules:					
		$\frac{1}{1000}$	$\frac{3}{5000}$	$\frac{2}{5000}$	$\frac{1}{5000}$	$\frac{1}{10\,000}$	$\frac{1}{20\,000}$
	No. of granules counted						
Chevallier	228	0.00	3.70	7.42	3.20	19.20	65.8
Goldthorpe	626	0.47	2.07	2.55	2.07	17.00	76.0
Standwell	445	0.00	2.19	5.06	2.36	14.70	77.0

(1) See LE CLERC, J. A. and LEAVITT, SHERMAN. — *U. S. Dept. Agr., Bur., Chem., Bull*, 128, 1910.

Thus Goldthorpe varieties contain a greater proportion of granules under $\frac{1}{10\,000}$ of an inch.

The effect of climate and soil on the proportions of the grains of different sizes still requires to be worked out.

The cell walls of the endosperm present no features which can be in any way regarded as characteristic of Chevallier and Goldthorpe respectively, although on the whole the laminae of the former are somewhat thinner and more delicate than those of the latter.

333 – **A Drought-resisting Adaptation in Seedlings of Hopi Maize.** — COLLINS, G. N. in *The Journal of Agricultural Research*, Vol. I, No. 4, pp. 293-301 + 4 plates. Washington, D. C., January 1914.

The proper depth at which to plant maize seeds has been the subject of many experiments, but with little consistency in the results. It does not hitherto appear to have been realised that it might be dependent upon a biological factor, definite for each variety or even each individual.

A study of the varieties of maize grown by the Indians in New Mexico and Arizona has brought to light an important adaptative character connected with germination and growth. Studies of seedlings of Hopi maize sown at different depths show that the mesocotyl, *i. e.* the portion of the stem between the cotyledonary sheath and the seed, may frequently develop to a length of 36 cm., and that it may give rise to roots at any point on its surface. Observations of many varieties of maize have shown that it is the elongation of the mesocotyl that enables the shoot to reach the surface, and the maximum extent of elongation is fixed and reasonably constant for each variety.

In the varieties of maize commonly grown the writer has been unable to force the mesocotyl to a length greater than 10 cm., and many seedlings have failed to come up where there was less than 2 cm. between the top of the cotyledonary sheath and the surface of the ground.

In the root system of the Indian varieties there are no secondary seminal roots, the radicle being the only root arising from the seed. These single seminal roots have been traced to a depth of 35 cm., and even further, and are obviously an adaptation to extreme conditions.

The Indians plant these seeds in hills about 20 feet apart, with from 10 to 20 plants in a hill There is no fixed depth for planting, the custom being to plant deep enough to place the seed in moist soil. The plants grow to a height of from 60 to 90 cm., and produce ears near the surface of the ground.

Under irrigation conditions these varieties compare favourably with the more improved eastern varieties in these dry regions ; 36 plants harvested gave 94 ears weighing 37.6 lbs.

The peculiar adaptations of these varieties — a greatly elongated mesocotyl, permitting deep planting and the rapid development of a large single radicle — give them considerable economic importance for the semiarid regions.

334 – **A Cultural Experiment with American and African Dent Corn.** — Wacker in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 3, pp. 73-75. Stuttgart, February 1914.

The comparative cultural experiments carried out in the summer of 1913 with Virginian and Natal corn showed that there is little material difference between the two kinds in yield of fodder.

This result agrees with those obtained in the writer's earlier experiments, but is at variance with the results obtained by Stebler and Volkart in 1907-1909 in Switzerland.

335 – **The Physiology of the Germination of Rice.** — Akemine, M. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 3, pp. 78-93. Stuttgart, February 1914.

The writer, who, during a series of years, has studied the conditions of germination of rice, summarises the results hitherto obtained as follows:

1) — The maximum, optimum and minimum temperatures for the germination of rice are 40° C., 30 to 35° C. and 10 to 13° C. respectively. From the practical point of view it is important to know that the development of strong seedlings is favoured by warm irrigation water.

2) — Light exerts no influence on the germination of rice.

3) — The same holds true for light of varying refraction.

4) — Rice germinates equally well both in water and in air, when the grains are husked or unhusked, and when the grains are treated with water which contains oxygen or which has been deprived of it by boiling.

5) — The plumule appears sooner if the grain is placed in favourable moisture conditions than in water.

6) — The radicles and crown roots develop considerably sooner in the air than in water.

7) — The stem grows much more rapidly in water than in the air. The opposite is the case with the radicles and crown roots.

8) — The frequent renewal of the water in the experiment had no sensible effect upon the development of the stem or roots.

9) — The same holds true for differences in the depth of water, provided they keep within the limits of 3 to 20 cm. (1.2 to 8 inches).

10) — The suitable degree of moisture for the germination of rice is 60 to 95 per cent. by weight of the seed-bed's capacity for water.

11) — Rice grains are saturated by an amount of water equal to about 25 to 30 per cent. of their air-dry weight.

12) — Rice grains cannot be made to germinate until they have absorbed about 25 per cent. of their air-dry weight of water.

13) — The loss of weight of the unhulled grains during steeping amounts to only 1.5 per cent. of their weight, even after 20 days, if the temperature is 10° to 15° C. (50° to 59° F.).

336 – **The Prevention of Degeneration in Potatoes.** — Communication from the "Saatzuchtstelle der Deutscher Landwirtschafts-Gesellschaft" in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, No. 7, p. 98. Berlin, February 14, 1914. ROOT CROPS.

The degeneration of a strain of potatoes originates as a result of any of the diseases which prevent their complete development. Its progress from

one generation to another can be prevented by means of the selection of tubers from well-developed plants marked in the fields during the summer; only such roots should be selected, as come up to the expectation of the previous selection. The tubers of each plant should be grown separately the following year, and the experiment repeated for several years until the desired result has been obtained.

337 - **The Effect of the Weight of Seed Potatoes Upon the Succeeding Crop.** — LYVK, A. v. (Author's abstract) in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, p. 72. Berlin, 1913.

In 1912, the weight of all the tubers of 24 potato plants was determined; those which weighed more than 15 grams (in some cases all the tubers of the plant) were planted. The estimation of the weight of the crop when gathered showed that the weight of the seed potatoes exercised a very great influence upon the total crop of the daughter plants. This influence was less noticeable and more inconstant in the case of the bigger tubers, but here also the heavier seed-potatoes produced the larger crops.

338 - **The "Amylometer": a New Apparatus for Estimating the Starch Content of Potatoes.** — MENZEL, V. and STEMPEL, G. in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Österreich*, Year XVI, Part 9, pp. 893-898. Vienna, 1913.

The writer describes a new apparatus by the use of which the starch content of quite a small number of potatoes, and even of a single tuber, can be determined. The apparatus is very useful for breeders who have to deal with a large number of single tubers.

339 - **A Society for Promoting the Cultivation and Economic Utilization of Potatoes (B. V. K.)** *Deutsche Landwirtschaftliche Presse*, Year XLI, No. 3, p. 30, No. 17; p. 210; *Zeitschrift für Spiritusindustrie*, Year XXXVII, No 10, p. 139. Berlin, Jan. 10, Feb. 23 and March 5, 1914.

During the great agricultural week held this year at Berlin, in February, a new society was founded for the promotion of the cultivation of potatoes and the encouragement of their use for various economic purposes.

The society has its seat in Berlin and is based up on the organization of the "Verwertungsverband Deutscher Spiritusfabrickanten", it has been recognized by the three most important societies for the promotion of potato cultivation in Germany, *viz.* the "Verein der Spiritusfabrikanten in Deutschland", the "Verein der Stärke-Interessenten in Deutschland" and the "Verein Deutscher Kartoffeltrockner".

The Society does not wish to promote potato growing at the expense of other crops, but desires to raise the yield per surface unit, which it tries to effect by instituting cultural experiments with different varieties, and by experiments in growing and manuring the crops, etc. It is also anxious, in order to develop the possibilities of utilizing the increased supply (a necessary condition of the attainment of its first aim), to improve the keeping qualities of the tubers by cheaper and better methods of preserving them, and to enlarge the market for fresh and dried products. The Association is endeavouring to centralise all scattered efforts in these directions. The members undertake to preserve a certain portion of their potatoes, the

amount depending on the crop and the condition of the market at the time; the potatoes are to be ensilaged or dried. It is hoped that by this means a balance will be kept between excessively large and small potato crops, and that the trade will be more regular and the prices steadier.

340 - **Grassland in Britain: Types and their Formation.** — SMITH, W. G. and CRAMPTON, C. B. in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 1-17, Fig. 1-4. Cambridge, January, 1914.

FORAGE CROPS. MEADOWS AND PASTURES.

In considering grassland from the ecological point of view (soil, climate and topography), the causes leading to its formation may be divided into two groups: 1) natural, and 2) artificial.

Natural grasslands can be separated into two groups, the stable and migratory types; the latter depend on periodic flooding, flushing and renewal of surface fertility; these types occur on alluvial and rain-washed or spring-flushed surfaces, along river and coastal belts, and on mountain slopes. The stable types, on the other hand, depend on the nature of the underlying rocks and their physiography, which limit the growth of tree vegetation and prevent infertility due to leaching and stagnancy. Such stable grasslands are found in Britain on: 1) chalk downs, 2) exposed hill and ridges of rocks containing an abundance of lime, such as limestone (including some calcareous or boulder clays, etc), and basic igneous rocks such as the isolated hills of dolerite common in Mid Scotland.

Artificially induced grasslands originated as the result of a widespread demand for pasturage and hay in districts where the natural grasslands are too limited for economic requirements. They usually show marked variations, apparently unconnected with the nature of the habitat, and frequently require constant attention to maintain their grazing value. Sometimes, however, they acquire a certain amount of stability by a process of evolution, following on the destruction of the original vegetation and a phase of tillage. Examples occur in the old established pastures of the midland counties of England.

Owing to the cold temperate climate with moist summers and open winter, grassland is not altitudinally zonal to climate in Britain; but this climate favours leaching and surface exhaustion in well-drained places, resulting in soil acidity and accumulation of peat, and these are the great physical enemies of grassland in this country. Thus one of the first signs of pasture deterioration in a wet district is the formation of a thick sod of mosses and plant remains, so dense that summer rains cannot penetrate to the soil below; surface-rooting species (*Agrostis*, *Anthoxanthum*, *Luzula*, etc.) then take possession, and deeper rooting species (*e. g.* white clover) dwindle away.

The natural conditions which favour grassland in Britain are therefore those which prevent:

1) leaching of the surface in well-drained positions, leading to competition with heath; 2) rapid accumulation of raw humus, and competition with moorland species; 3) stagnancy and souring of the soil in low-lying positions, and competition with marsh; 4) the growth of forest.

The factors preventing leaching on an elevated or well-drained area are : *a*) a finely divided thin residual soil resting on a soluble or smooth weathering rock basis which constantly supplies mineral nutriment, especially lime ; *b*) periodical flushing of sloping surfaces with waters containing alkaline bases in solution, a natural process corresponding to the artificial top-dressing of basic slag and phosphates. Examples occur on exposed alpine, coastal or moorland slopes.

The factors preventing the souring of the soil and rapid accumulation of raw humus are : *a*) alternate flooding and rapid drainage, *b*) a sufficiency of alkaline bases in solution or in suspension where drainage is less efficient.

The factors which prevent the growth of forest are: *a*) great wind exposure, *e. g.* coastal slopes, coastal plains and plateaux ; *b*) a shallow soil over smooth, unfissured rock in exposed positions allowing no foothold for trees); *c*) a water-table too high, or a roothold too unstable, on wind-swept alluvial surfaces. The establishment of grassland attracts grazing animals which are a most efficient means of suppressing tree seedlings.

Natural grasslands are therefore restricted to :

1) Stable surfaces with a smooth elevated topography and a thin, finely-divided soil supplied with alkaline bases from underlying rocks.

2) Sloping smooth surfaces subject to periodical flushing with mineralised waters.

3) Alluvial surfaces along rivers, periodically flooded and drained.

4) All surfaces favourable for grass roots in places much frequented by grazing animals.

The vegetation of unstable surfaces is rapidly changed in character in places neglected by grazing animals, whereas it may persist and become more extensive if well stocked.

Types of grassland occurring in Britain.

I. *Turf-forming types.* — These are pastures of natural formation and are usually closely cropped and perennially green. Their vegetative growth consists of aerial and subterranean leafy shoots which seldom flower. On stable formations such as chalk downs, ridges and maritime slopes, wiry grasses such as sheep's fescue (*Festuca ovina*) predominate, with scattered, large-rooted procumbent or acauline rosette plants, or trailing small-leaved herbs ; mosses are scarce or absent ; snails, worms, ants and other invertebrates are abundant. The migratory or mat-pastures occurring on flushed slopes consist chiefly of grasses with flat and short leaves, such as *Agrostis* forms, *Anthoxanthum, Triodia,* and *Cynosurus*, and others such as *Holcus lanatus* ; sedges of the *Carex panicea* or C. *flava* type occur ; mosses like *Hylocomium squarrosum* or *Hypnum molluscum* are abundant; the invertebrate fauna is less abundant than on the down types ; slugs generally replace snail,dipterous larvae are abundant, while ants are usually absent. The vegetation is often glaucous in tint and unwettable, and contains some rosette-leaved plants with tall flowering shoots.

II. *Meadow types.* — These occur on porous alluvial loams with a high water-table and subjected to flooding, and are characterised by taller herb-

age including grasses of tufted and creeping habit. The grasses of lowland types consist of broad-leaved fescues, *Poa trivialis, Dactylis, Phleum, Alopecurus*, etc.; maritime types have *Hordeum, Phleum, Lolium, Triticum*, etc., and alpine types have alpine forms of *Festuca, Aira, Phleum, Poa*, etc.

III. *Tussock types.* — These occur in many parts of the world on salt-steppes, wind-blown steppes and under conditions of perennial cold or wind. They are composed of coarse, hard or or wiry grasses which tend to accumulate soil by means of stools or tussocks of dead shoots. These types appear to be limited to unstable habitats in Britain, such as waste heaps of mines and quarries, and artificially degenerated moorlands (*Nardus*).

IV. *The Stooled Meadow types.* — These may be considered as exaggerated forms of the tussock type, assuming the stooled habit as an adaptation to gentle flooding and silting. The principal grasses are *Aira coespitosa* and *Molinia coerulea.* Tall rushes and stooled species of Sedge (*e. g. Carex paniculata*) are often present.

V. *Lair grasslands and the Camp-follower types.* — This heterogenous group of grasslands is independent of physiographic and soil conditions. They are of a migratory character and depend on the influence of grazing animals for their formation and persistence. Examples of this type are found in the neighbourhood of shelters and enclosures for sheep and cattle, and near rabbit warrens.

Economic Aspects.

From a consideration of the natural factors which lead to the formation of grasslands, the following deductions may be made:

1. Where these factors are in operation, and stable in character, no artificial interference is necessary to procure good sheep-grazing, and no other treatment than judicious stocking should be attempted until well-established results based on experiment are obtained.

2. Interference with the development of natural migratory grasslands should not be undertaken without a careful consideration in each case of the physiography or " lie of the land ", the nature of the waters and their suspended materials, and the effect of tampering with the drainage. (Thus, while the natural flushing of peaty moorland by water often leads to the appearance of patches of grassland, the conduction of such waters on to the grasslands of the stream alluvia will in most cases promptly lead to marked deterioration in the pasture. Again, the underdraining of sandy loams only accelerates the leaching natural to them, and thus favours heath unless frequent surface manuring with lime or slag is carried on).

3. The grazing and manuring of sheep and cattle on moorlands can do much to establish grassland where migratory geological factors are in operation, but no amount of overstocking will be effective if leaching has reduced fertility and induced acidity.

4. Stability may be acquired by a gradual process of natural selection of those forms of grasses and other plants which are most suited to the treatment in vogue, including grazing. (These differences in the same

species of plants in different fields may account for the differences in the feeding value of pastures having the same botanical analysis).

5. In determining treatment for the improvement of grassland, it seems more probable that careful experiment will lead to better conclusions than botanical analysis alone. An interpretation of results obtained by the application of manures or other treatment in consideration of the physiography, origin and history of the locality, would appear to be the more logical method.

341 - **Rye-Grass and Clover in India.** — BROWN, W. ROBERTSON in *The Agricultural Journal of India*, Vol. IX, Part I, pp. 87-91 + 1 plate. Calcutta, January 1914.

The occurrence of the darnel grass (*Lolium temulentum*) in the wheat fields of the N. W. Frontier Province and Punjab suggested the introduction of Italian rye-grass (*Lolium italicum*) as a forage grass for the cold season.

Experiments with this grass in combination with broad red clover (*T. pratense*), shaftal (*T. resupinatum*), berseem (*T. Alexandrinum*) and lucerne, show that it gives a weight of green fodder equal to the clover-hay crops obtained from the average English rye-grass-clover meadows. Sowings made in August and September on manured and irrigated land enabled three cuttings to be made during the cold season, *viz.* November, February and May.

The local advantages of such a crop are: 1) the cheap rate at which it may be cut by means of a sickle or mower, and 2) a yield of succulent grass when indigenous grasses are not available.

FIBRE CROPS.

342 - **Cotton in Asiatic Russia.** — SCHANTZ, M. — *Beihefte zum Tropenpflanzer*, Vol. XV, No. 1, 134 pp. Berlin, February 1914.

This important monograph on the cotton question in Asiatic Russia completes the series of studies on cotton published by the writer.

It begins with an account of the general conditions of agriculture in Turkestan: the dry and distinctly continental climate characterised by considerable variations of temperature (—44° to + 55° C.), the necessity for irrigation, the very fertile soil, chiefly consisting of loess of Eolian origin.

Varieties. — The most important native varieties are those of Tashkend, Bokhara and Khiva. The latter is more renowned; it yields 26 per cent. of thread with a staple of 20 mm. length. Bokhara cotton has a staple of from 22 to 23 mm. in length, but is coarser.

The native varieties are characterised by the fact that their capsules scarcely open or even remain completely closed at maturity.

The cultivation of American varieties, introduced in 1870, has developed considerably since 1884; they now occupy 90 per cent. of the cotton area. American cotton gives a yield of thread of 30 to 35 per cent. and has a length of staple of 29 to 30 mm. The best varieties are King and Triumph. Turkestan cottons of American origin realise the price paid for Orleans-Texas "good middling" quality of 28-29 mm. length.

Commercial qualities. — There are three principal qualities, *viz.* 1) consisting of white fibres, 2) yellow fibres or slightly damaged by the cold, 3) grey fibres, of a deep yellow colour or strongly damaged by cold.

The cotton zone extends from 37° to 45° N., so that itssouthern limit is the northern limit of the American " Cotton belt ".

The cultivation is almost entirely in the hands of natives, whose farms average from 2 to 5 acres and produce 90 per cent. of the total cotton crop.

Cultivation. — The virgin lands are too saline for the direct cultivation of the crop. The preparation of the land consists in the removal of the salt by irrigation and the cultivation of lucerne for several years. No regular rotation is followed; cotton is grown continuously until the yield diminishes, when maize or leguminous crops are grown for several years.

The cultural operations are as follows :

1) Autumn tillage (6 to 8 inches), preceded by irrigation if the land is too hard.

2) Spring cultivation to a depth of 14 inches.

3) Application of fertilisers, chiefly canal mud.

4) Preparation of the beds 28 to 32 inches broad and 10 to 18 inches high. When water is plentiful the furrows between the beds are constructed in a sinuous course so as to decrease the flow of water and obtain a better soaking of the soil.

5) Irrigation, if the soil is too dry for sowing, which is seldom the case.

6) The seeds are dibbled in holes 20 to 28 inches apart. The seeds should be two years old in order to ensure regular germination, and obtained from the first picking. From 20 to 30 seeds are sown in each hole owing to their low germinating power (60 %) and to facilitate the penetration of the surface crust of the soil by the combined efforts of several shoots.

7) Irrigation, singling, weeding. The determination of the correct quantity of water is a very important and delicate problem. In Turkestan too much water is generally given; 3 or 4 irrigations in place of the 10 to 12 are sufficient.

8) Topping of the plants as soon as the flowering reaches a maximum (the first half of July).

9) Picking from the middle of August until October, November and even December, should the weather be suitable.

The Upland cotton is picked as in America. In the case of the native varieties, the entire capsule is picked and the cotton separated after drying. The months of September and October in Turkestan are warm and dry, thus favouring the picking. The stems of the plants are used as fuel.

Pests. — The crop is subject to few insect and fungoid pests in Turkestan. Some regions, such as the Hungry Steppes, have been invaded by flying locusts, but the development of these is checked by irrigation.

Area under cotton and yield. — In 1913 there were 1 127 000 acres of cotton in the four " crown countries " of Turkestan, distributed in the following manner :

Ferghana	729 000
Syr Daria	205 000
Samarkand	79 000
Transcaspia	114 000

The total yield of cotton, including Bokhara and Khiva, increased from 127 000 tons in 1908 to 182 000 tons in 1912-13 distributed as follows:

	Thousands of tons
Ferghana	113
Syr Daria	13
Samarkand	10
Transcaspia	15
Bokhara	21
Khiva	10

The average yield per acre is:

Upland	210 to 235 lbs
Native varieties	170 lbs.

Of the various cotton regions of Turkestan studied by the writer, *Ferghana*, which produces two-thirds of the cotton in Asiatic Russia, deserves special mention. Owing to its situation in a valley sheltered from cold winds, it has a relatively temperate climate. The cultivation is extending rapidly:

1888	91 000 acres
1900	502 000 »
1910	635 000 »
1913	729 000 »

American varieties are almost exclusively cultivated. The cotton is of a beautiful white colour, with silky resistant fibres of 29 to 30 mm. staple. The first quality, comprising 60 to 70 per cent. of the harvest, is classed between " good middling " and " fully middling ".

Rotations :

1. Cotton	8 to 10 years
Sorghum or maize	2 »
2. Cotton	8 to 10 »
Lucerne	5 to 7 »
Sorghum or maize	1 »

Yield. — In 1913 the yield per acre in the district of Andidjan in good estates was about 450 to 550 lbs. for Triumph and 350 to 450 lbs. for King.

Cost of maintenance of one "dessiatine" (2 3/4 acres).

	£	s	d
Manures	2	2	0
Distribution		2	6
3 cultivations	1	18	0
Preparation of beds	1	5	6
Seed		8	0
Sowing		10	0
Singling		9	0
8 irrigations		10	0
Upkeep (weeding, etc)	6	2	0
Picking	1	18	0
Various	1	5	0
Total . . . £	16	10	0

343 - **The Cultivation of Paprika Pepper in America.** — YOUNG, T. B. and TRUE, R. H. — *Bulletin of the U. S. Department of Agriculture*, No. 43, 24 pp. + 11 figs. Washington, D. C., December 16, 1913. VARIOUS CROPS

Paprika is a pungent red pepper obtained by grinding the fruits of a Hungarian variety of *Capsicum annuum*. The Spanish variety known as "pimiento" or "pimienton" is distinguished from it by being sweeter and less pungent. The quality of paprika depends on its colour, pungency, swetness and flavour. The colouring matter occurs in the "shell" of the fruit and is preserved in the final product by grinding it with the seeds, which contain an oil in which the colouring matter is soluble. The pungency is due to a crystalline substance known as capsaicin ($C_9\ H_{14}\ O_2$), found only in the placentae of the pods. The degree of pungency of the product depends therefore on the extent to which the placentae are included in grinding the fruits. Comparative tests of the degree of pungency are made by determining the proportion of finely ground sugar required to be added to cause the pungent taste to just disappear.

Experiments with different samples showed that Hungarian paprika varied in pungency from a ratio of 1 : 300 to 1 : 1360 of paprika : sugar. Home-grown American samples were in general superior to the Hungarian samples ; their degree of pungency varied from a ratio of 1 : 500 in the case of a sample made from the shells alone to 1 : 19000 in the case of a sample made entirely from placentae.

The sweetness of the product is due to the sugar contained in the shells of the pods. Analysis showed that dried shells contained 24.6 per cent. of glucose and 1.7 per cent. of cane sugar. Sun-dried pods from Texas showed only 2.5 per cent. of glucose and 5.9 per cent. of cane sugar.

Cultivation. — As an annual, it is propagated exclusively from seed. The yield of pods is determined by the length of the growing season. In the experimental area in South Carolina the growing period is from 230 to 240 days with a mean summer temperature of 78° F. Abundant sunshine adds brilliancy to the colour and assists in bringing about a uniform ripening of the fruit.

The average yield and profits for four years are given below:

Average yield per acre	Price per pound	Total income per acre	Average cost per acre	Average profit per acre
1092 lbs.	9.3 cents	$ 102.23	$ 31.97	$ 70.26

The items of expenditure in the production of the crop include:

Preparing and sowing the seed bed.
Preparing and cultivating the land.
Transplanting plants to field and resetting to stand.
Fertilisers.
Picking the fruits.
Handling peppers, care of fires during curing, etc.
Fuel (pine wood).
Grading, sacking, handling, etc.

The cultivation of this crop would be profitable under present conditions, but any considerable increase in the supply would reduce the market value of the product.

MARKET GARDENING.

344 - **Ornamental Hibiscus in Hawaii.** — WILCOX, E. V. and HOLT, V. S. in *Hawaii Agricultural Experiment Station, Bulletin*, No. 29, pp. 60 + 16 coloured plates. Honolulu, December 1913.

The writers describe the treatment and propagation of hibiscus, of which about 500 varieties or sub-varieties exist in Hawaii, 240 of them being of some interest.

FRUIT GROWING.

345 - **The Pollination of the Sweet Cherry** (1). — GARDNER, V. R. in *Oregon Agricultural College Experiment Station, Division of Horticulture, Bulletin* No. 116, pp. 3-40. Corvallis, Oregon, August 1913.

Experiments on the pollination of sweet cherries showed that all the varieties tested were self-sterile and that inter-sterility is an important factor determining the success or otherwise of cherry growing.

No evidence has been obtained to show that inter-sterility is correlated with closeness of relationship. The potency of any particular variety of pollen appears to be considerably influenced by environmental factors.

The grafting of inter-fertile varieties is recommended for the improvement of the yield of orchards containing single or inter-sterile varieties. For immediate results, recourse may be had to placing branches of suitable varieties in buckets of water in the orchards during the blossoming period, and the encouragement of beekeeping.

346 - **Frost Protection in the Limoneira Lemon Orchards.** — CULBERTSON, J. D. (Assistant Manager Limoneira Company) in *Monthly Bulletin of State Commission of Horticulture*, Vol. III, No. 1, pp. 1-8. Sacramento, Cal., January 1914.

Experiments have been carried out in the lemon orchards of the Limoneira Company, Santa Paula, California, on the use of coal and oil fuels, as a means of preventing frost injury.

Oil gave the best results as regards both efficiency and cost of labour. Though the fruit was badly sooted, the trouble of washing with cheap kerosene and soap wash was more than compensated by the success of the crop. Each tree was protected by an oil pot, and the temperatures in different parts of the orchard were recorded at the central station by means of a telephone system. The best type of oil pot was found to be one fitted with a "down-draught" tube, either perforated or slit, so as to maintain an ample supply of air at the surface of the burning oil.

(1) See also No. 133, *B.* Feb. 1914. *(Ed).*

Cost and maintenance of equipment for an orchard of 500 acres.

	$
50 000 oil pots	50 000
2 steel storage tanks of 5 000 barrels capacity	4 885.89
2 cement reservoirs of 100 000 gallons capacity, equipped with pump.	3 000
5 miles of 3 inch and 4 inch pipe line	6 375.03
35 tank wagons and tanks	4 315.00
150 spout pails for filling pots	300
200 torches	200
50 thermometers	150
4 miles of telephone system	750
350 000 gallons of oil in orchard at 2 $^1/_2$ cent	8 750
500 000 gallons of oil in storage at 2 $^1/_8$ cents	12 500
Total investment for 500 acres	$91 225.92

The annual interest, deterioration, and maintenance expense per acre, excluding cost of operating, is as follows:

	$
6 % interest on total investment	10.94
15 % deterioration on on $ 100 worth of pots	15.00
6 % deterioration on balance of equipment	2.40
Estimated maintenance: handling, painting, filling	5.00
Total	$33.34

The writer points out that the danger of a deficit is far more serious than a possible lessening of profits in attempting citrus growing in cold areas.

347 - **A Trial of Orange Stocks at Peshawar.** (N. W. Frontier Province, India). — BROWN, W. R. in *The Agricultural Journal of India*, Vol. IX, Part I, pp. 84-86 + 4 plates. Calcutta, January 1914.

Four different varieties of citrus are used as stocks for budding the Malta and Sangtara oranges north of Delhi, *viz*: 1) the " mitha " or sweet lime, said to produce sweet thin-skinned fruit; 2) the " khatti " or small sour lime, on account of its vigour; 3) the " khatta " or large sour lime, and 4) the " gulgul " or coarse citron, for inducing early growth and maturity.

Experiments at Peshawar showed that Maltas grow best on the " khatti " stock, while Sangtaras are more successful on the " mitha " or " gulgul " stocks. Further experiments are required to determine the best stocks for other localities, and for developing such characters as flavour, thinness of skin, date of ripening, early fruitfulness, length of days and power to withstand excessive irrigation.

348 - **Chestnut Hybrids in America.** — VAN FLEET, W. in *The Journal of Heredity*, Vol. V, No. 1, pp. 19-25 + 5 plates. Washington, D. C., January 1914.

Since 1894 numerous crosses have been made between Asiatic, European and American species of chestnut. All hybrids derived from

Castanea americana were found susceptible to the destructive bark disease *Endothia parasitica*.

The most promising results have been obtained in crosses between the American chinquapin (*C. pumila*) and the Japanese chestnut (*C. crenata*). These hybrids form vigorous, small, much-branched trees, rarely shrubs, and come into bearing at from 3 to 5 years old. They bloom profusely and the burs are borne in clusters or racemes of 3 to 5 or more, containing nuts intermediate in size between those of the parents. The nuts have none of the starchy and tannin-like flavours so common with European and Asiatic chestnuts, but are not so sweet as the wild chinquapin.

The disease-resistance and early fruiting of these hybrids gives them great promise from a horticultural point of view.

LIVE STOCK AND BREEDING.

HYGIENE

349 – **Effect of Smoke on Stock Farming.** — *The Journal of the Board of Agriculture*, Vol. XX, No. 10, pp. 896-898. London, January 1914.

In connection with the investigations being carried on at Leeds University on the effect of atmospheric impurities on vegetation, an enquiry was addressed to the farmers of the district with regard to the effect of town smoke on stock farming. The results show that a polluted atmosphere is deleterious to both cattle and horses; young stock do not thrive, and adult stock require more food and greater care than similar animals in a less contaminated atmosphere, the ill effects being due partly to the direct respiration of the smoke-laden air, and partly to the effects of the smoke on the grass. Sheep are rarely seen in these districts, as, in addition to the difficulties of rearing and fattening stock, the depreciation in the market value of the animals as a result of the blackening of the wool by smoke has to be taken into account.

The harmful effect of a smoky atmosphere seems to be cumulative from generation to generation.

350 – **A Preliminary Report on the Investigations of Bovine Red Water (Cystic Hematuria) in Washington.** — KALKUS, J. W. — *State College of Washington, Division of Veterinary Science, Bulletin* No. 112, pp. 1-27. Pullman, Washington, October 1913.

Cystic Hematuria is a local disease prevalent amongst dairy cows in the western part of Washington State, especially on rough, hilly ground. It is sporadic and characterised by a constant or periodic discharge of blood in the urine and by vascular lesions on the mucous of the bladder. Blood from an affected animal produced no ill effects when injected into a healthy animal, but the disease was transmitted by inoculation with the bladder lesions, though no causative organism has so far been isolated. The disease is chronic; some drugs seem to afford temporary relief, but affected cows usually succumb eventually.

351 - **Comparative Histology of Alfalfa and Clovers.** — WINTON, K. B. in *The Botanical Gazette*, Vol. LVII, No. 1, pp. 53-63, + 8 figs. Chicago, Ill., January 1914. FEEDS AND FEEDING

Owing to the growing importance of alfalfa and clovers as feeding stuffs and their suitability for grinding into meal, a means for their microscopic identification is required.

The highest feeding value of the hay or meal is obtained from plants cut early in flower, though more or less mature fruits and seeds are not infrequently found in the products on the market, especially in alfalfa meal.

In a coarsely ground product, fragments of leaves, flowers, pods and seeds may be picked out and identified; but when powdered the unicellular hairs and crystals are the most conspicuous elements. Red clover may be distinguished from alfalfa and alsike clover by its larger, stiffer and more numerous unicellular hairs arising from a swelling of the epidermis; alsike clover from alfalfa and red clover by the less distinct warts on the unicellular hairs.

The cell-walls of the epidermis of the leaf are also characteristic, those of alsike clover being straight, of alfalfa simply wavy, and of red clover very sinuous with projections at the angles and about the stomata.

The characters for identification may be summarised as follows:

	Alfalfa	Red Clover	Alsike Clover
Lower epidermis of leaf.	Wavy walls.	Deeply sinuous walls with projections at angles and about stomata.	Straight walls.
Unicellular hairs.	Average diameter 15 μ; warts prominent.	Average diameter 30 μ; warts prominent, arising from epidermal swelling.	Average diameter 13 μ; warts indistinct.
Palisade cells.	Less than 35 μ high, outer ends rounded.	More than 35 μ high, outer ends flattened.	More than 35 μ high, outer ends rounded.

352 - **A Note on Sex Determination.** — (Contributions from the Zoological Laboratory of the Museum of Comparative Zoology at Harvard College. No. 245). — PARKER, G. H. in *Science*, Vol. XXXIX, No. 997, pp. 215-216. New York, February 6, 1914. BREEDING

In collecting a series of data to show the relation of the size of litters to the number of nipples in swine, the records noted the position occupied by the young pigs in the uterus, and it has therefore been possible to compare the products of one ovary with those of the other. Pairs of young pigs immediately against the ovary in the right horn of the uterus, similar pairs in the left horn, and pairs at the junction of the horns were tabulated according to whether they consisted of males only, of females only, or of males and females, the observations extending over 2600 pairs of unborn

pigs. In all three positions the frequencies of the pairs were approximately in the ratio of:

25 per cent.	. . . .	males only
25 » »	. . . .	females »
50 » »	. . . .	males and females

showing that in the pig the ovaries exert no influence on the sex of the offspring by virtue of their position in the maternal body.

353 – **A Further Study of Size Inheritance in Ducks, with observations on the Sex Ratio of Hybrid Birds.** — PHILLIPS, J. C. (Bussey Institution) in *The Journal of Experimental Zoology*, Vol. XVI, No. 1, pp. 131-148. Philadelphia, Pa., January 5, 1914.

As the result of crossing Rouen ducks with domesticated mallards (*i. e.* races dissimilar in size but derived from the same wild species), the weights of adult birds showed an increased variability of the males in the F_2 generation, while the variability of the females remained practically the same as in the F_1 generation. No evidence was obtained in favour of the existence of simple and definite size units in the birds. A disturbed sex ratio occurred among the F_1 generation, resulting in a preponderance of males almost in the proportion of two to one, but equality in sex numbers was reestablished in the F_2 generation. Owing to the fact that other investigators have expressed a doubt as to the Rouen colouring being homozygous, the writer mentions that he obtained no evidence to the contrary in his experiments.

A number of growth charts are given and discussed.

354 – **Rudimentary Parthenogenesis in the Golden Pheasant.** — LÉCAILLON, M. in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 158, No. 1, pp. 55-57. Paris, January 5, 1914.

The writer had already remarked that unfertilized hens' eggs show traces of rudimentary parthenogenesis. He has made investigations on unfertilized eggs from a hen golden pheasant (*Chrysolophus pictus*) to find out whether the same applies to this species.

In the egg of this species, as in that of the hen, the cicatricula shows two distinct zones: a dense central one, and a peripheral one containing vacuoles of air. In unfertilized eggs the cicatricula is much smaller than in fertilized ones; this is due to the fact that in an unfertilized egg the cicatricula spreads less over the yolk while passing through the oviduct. Under the microscope the dense part of the cicatricula shows blastomeres of varying size and of lenticular shape; it is difficult to determine their number; in the peripheral part no subdivision of the cells can be determined. The blastomeres are composed of cytoplasm and deutoplasm and contain normal nuclei. They are therefore cells which have undergone true division, and not simply products of disintegration of the germinal vescicle. At the same time, as in hens' eggs, the nucleus is only visible in recently-laid eggs.

The degeneration of the blastomeres is often characterized by hypertrophy of the nuclei, again as in hens' eggs; these nuclei form numerous fresh nuclei of various sizes by budding.

The formation of the vacuoles in the peripheral part of the cicatricula takes place in the golden pheasant's egg in the same way as in the hen's egg; but in this part the degeneration of the deutoplasm takes place less rapidly than that of the nucleus.

These observations strengthen the idea that unfertilized eggs always show a tendency to develop like fertilized ones.

355 – **Some New Varieties of Rats and Guinea-Pigs and their Relation to Problems of Colour Inheritance.** — CASTLE, W. E. (Harvard University) in *The American Naturalist*, Vol. XLVII, No. 566, pp. 65-73. Lancaster, Pa., February 1914.

Attention is drawn to the appearance in England of two new colour variaties of rats, *viz.* (*a*) pink-eyed yellow, fawn, or cream and (*b*) black-eyed yellow, fawn, or cream. Both varieties originated in the wild state and were possibly introduced by ships from abroad. In captivity they have bred successfully, and both proved recessive when crossed with the wild race. The writer discusses some of the breeding results communicated to him by the fanciers who are in possession of the above animals, and the relation of these results to colour inheritance amongst mammals in general.

356 – **"Dominant" and "Recessive" Spotting in Mice.** — LITTLE, C. C. (Bussey Institution, Harvard University) in *The American Naturalist*, Vol. XLVIII, No. 566, pp. 74-82. Lancaster, Pa., February 1914.

A wild mouse with a 'blaze' on the forehead was crossed with a dilute brown individual which had been closely inbred. All the F_1 generation resembled the wild parent in coat colour, but had no trace of white. The F_2 generation contained animals of three types, *viz.*: I) self-coloured, II) those with a blaze, and III) those with a few white hairs on the forehead. Animals of type III, bred *inter se*, again produced the three above types, as did those of type II, though in this case the self-coloured animals produced only amounted to 1 per cent. Thus while spotting behaved as a *recessive* in F_1, it behaved as a *dominant* in certain of the F_2 individuals; yet, as the spotting character came from a single individual, it appears improbable that it should be of two distinct types.

The writer discusses his results together with those of Miss Durham and Hagedoorn, and concludes that dominant spotting is not caused by the presence of a factor restricting pigment formation in certain areas which is absent in the 'self' colour; neither can the presence and absence hypothesis account for the changing dominance which he observed, and which he attributes to a modification of supplementary factors.

WORK OF LIVE-STOCK ASSOCIATIONS AND OTHERS FOR THE ENCOURAGEMENT OF BREEDING.

257 - **Stock Breeding in Southern Italian Somaliland.** — SCASSELLATI-SFORZOLINI, GIUSEPPE, pp. 242 + 62 ill. and 1 map. Rome, 1913.

The climatic and geological conditions of the Protectorate of Southern Italian Somaliland (1) are on the whole well suited to stock breeding, though varying somewhat from place to place. This industry is the only source of income from agriculture, and the animals raised are chiefly cattle, sheep, goats, camels and donkeys. The herds of cattle graze upon the rich fertile meadows on the alluvial soil (*harra medou* = black soil) along the rivers Juba and Shebeli, while the camels are kept upon the less fertile alluvium (*harra gudud* = red soil) of the river valleys, and on the dunes (*harra adda* = white soil) which stretch along the sea-shore. Sheep graze after the cattle, and goats after the camels. There are no statistics as to the number of stock in the Protectorate; but the writer estimates the numbers in 1910 at 764 000 cattle, 216 000 sheep and goats, and 305 300 camels and other domestic animals. In comparison with the other African colonies, Southern Italian Somaliland seems to be fairly well stocked.

I. *Breeds of Cattle.* — There are four breeds of cattle in the Protectorate, all of which are zebus: the Macien or Surca, the Gasara, the Dauara and the Magal. The two former are somewhat less primitive than the two latter.

Macien breed. — These are long-horned animals, probably from Ethiopia, and are also found in British East Africa. Colour usually red, seldom white, never black, often mottled with yellow; head and neck nearly always red; a white line above the nostrils and round the ears is characteristic; muzzle and hoofs yellowish to red. Hump low but very wide; dewlap and sheath of bulls very prominent. Skin generally coarse. Profile nearly straight; forehead broad and flat or slightly dished; ears medium-sized, slightly drooping. Limbs fairly well set on; rump sloping. The height at the withers averages 4ft. 2 in; horns 16 to 20 in. long. The live-weight of a bull in average condition is about 880 lbs., while that of a fairly good cow is about 660 lbs. Sexual dimorphism is very conspicuous in this breed. The cow gives little milk, but the fat content of the latter is high. It is a good beef breed.

Gasara breed. — These animals are short-horned, frequently hornless or with small cylindrical horns. Colour originally white, but pure-bred white individuals are rare; they are generally spotted with black and red; muzzle and hoofs black, as also the tip of the tail. Hump higher than broad; dewlap and sheath rather prominent in animals which are not pure bred. Skin thin and fine. Face distinctly dished; forehead not very broad; ears larger than in the Macien and horizontal. Position of legs good to very good. Rump less sloping, and sexual dimorphism less strongly marked than in the Macien. Height at withers about 3 ft. 10 in.; horns up to 8 in. Live-weight of a cow in average condition about 550 lbs., of a bullock 660 lbs. The cows are excellent milkers. The breed is susceptible to trypano-

(1) The area of the Protectorate was about 12000 sq. miles up to March 1912, when a further 62000 sq. miles were added; the studies were made from September 1911 to June 1912, and therefore chiefly relate to the area annexed before March 1912.

somiasis, but this disease is not of frequent occurrence. The Gasara breed is widely spread in Southern Italian Somaliland, including the dunes along the coast, and is also found in British Jubaland.

Dauara breed. — The writer believes this breed to be derived from a cross between the two previously mentioned. There are occasional very large animals with small black horns. Colour whole chestnut. Dewlap, sheath and purse very prominent. Hoofs black. Tip of tail reddish. Ears long. Skin very fine, forming folds at the neck. Udder of cows large. These cattle are suitable for both milk and beef production.

Maga breed. — Short-horned, small and badly-shaped. Colour black, but often flecked with white on head and body. Hump very large. Head long with dished forehead. It is not a favourite breed owing to its poor performance and its black colour.

II. *Camels.* — These are exclusively one-humped ; the Somalis divide them into several races by their colour.

III. *Goats.* — These all belong to one type; the height at the withers is 24 to 30 in. and the live-weight 55 to 88 lbs. They are usually white, seldom red and never black; generally pied, particularly white with head, legs and a stripe down the back red or black; red-headed animals generally have two white stripes running from the eyebrows to the nostrils. Ears fairly long, upright or slightly drooping. Sexual dimorphism marked: males have the head large and the neck thick, and backwardly curved horns; along the back there is usually a strip of silky hair. The females are more slightly built, and have a well shaped udder. The Somalis distinguish two breeds: a long-eared one for milk and a short-eared one for meat production.

IV. *Sheep.* —These, like the goats, all belong to one type. The height at the withers is 26 to 28 in. and the live-weight 55 to 88 lbs. Body white, with head generally black, but not infrequently red, or white like the rest of the body. Face strongly dished ; small horns sometimes occur in the rams, but the ewes are always without them ; ears long and drooping. The Somali sheep has no wool, and is a fat-rumped species belonging to the group of *Ovis steatopigia* or *ecaudata.*

V. *Donkeys.* — These are descended from the Somali wild breed (*Equus asinus somali*) and are much lihe the Abyssinians. They are slate-grey and stand 9.2 to 11 hands high. Head heavy, face dished ; ears smaller than in the European donkey. Herds of donkeys are very little kept.

Mules are of very secondary importance ; as there are no horses, all are imported from Eritrea and Abyssinia.

There are very few *ostriches, fowls* or *bees.*

VI. *Methods of stock-keeping and rearing.* — In the neighbourhood of villages where there is a constant market for milk and meat, a certain number of cattle are kept stationary; during the day they graze near the village and at night are shut up in enclosures called *zeribe*; in the dry season they sometimes get a little fodder. Otherwise the herds migrate from place to place according to the condition of the pastures.

The Somalis make some attempt at selecting their bulls ; only the finest are reared, and eventually those producing good daughters are kept on as

sires. On the other hand all heifers are put to the bull, the reason being that milk and veal are the chief foods of the natives. Bulls come into service at 2½ or 3 years, while the heifers are put to them at 2 to 3 years.

The calves are weaned at 4 or 5 months, which is decidedly too soon, especially as their dams are also milked.

The Somalis have no knowledge of hay- making. When the rivers and springs dry up, they dig wells for watering the cattle.

VIII. *The economic value of the stock and its products.* — The value of the stock to the natives depends chiefly upon its milk and meat production. The camel is prized for both these reasons, and also for the work it performs. The daily milk yield of a fairly good cow is about 5 quarts, and a she-camel will give this amount besides what the calf takes. The price of milch animals depends on their yield; a good cow fetches from £ 3 to £ 5 and a very good milch camel from £ 4 to £ 5. Cow's milk is sold at 9*d* a gallon and camel's milk at 4 ½ *d*. Superfluous milk is made into butter, and this and the skim milk are favourite foods; the price of butter is about 8*d* per lb. Most of the butter exported goes to Arabia and Zanzibar. The amount exported has fallen from 500 000 lbs. in 1905-06 to 145 000 lbs. in 1911-12.

The meat production, although chiefly destined for home consumption, is already considerable. The natives like to turn to account all otherwise useless animals by slaughtering them for food. The Macien breed is the most suitable for fattening owing to its early maturity. The price of cattle for the butcher varies with the weather and the diseases prevalent. At present, a good fat ox fetches 19 *s* to 35 *s*, while the price of an average sheep is 6*s* to 8*s*.

The price of meat continually varies with the price of the animals slaughtered; at Jumbo and other coast towns beef costs about 1 ¾ *d* per lb., and at Gelib only a little over 1*d* per lb. A pound of mutton costs 3 ½ *d* at the first-named places. The entire trade in meat and animals for the slaughter-house is a monopoly of the Arabs, Indians and natives, who ship all superfluous cattle to Aden, Mombasa and Zanzibar. Table I shows the importance of the export trade in animals for the slaughter-house from 1905 to 1912.

TABLE I.

Year	Cattle		Sheep and Goats	
	Number of head	Value £	Number of head	Value £
1905-1906	1 751	2 602	10 272	2 396
1906-1907	1 727	2 643	9 157	1 631
1907-1908	3 295	2 600	7 733	1 735
1908-1909	1 959	3 758	8 280	1 968
1909-1910	1 507	2 678	7 361	1 833
1910-1911	1 694	4 356	7 642	2 122
1911-1912	1 943	3 896	7 113	1 976

Animals are little used for work, except camels. Only one or two hundred camels are exported annually, at from 47s to 55s per head. More important articles of export than draught animals are hides, of which the following numbers were exported between 1905 and 1912:

Ox hides	to the		value	of	£	18 061
Camel skins	»	»	»	»	£	729
Sheep and goat skins	»	»	»	»	£	10 735

The value of the ostrich feathers annually exported amounts to some hundreds of £.

IX. *Encouragement given by the Government to stock-breeding.* — The Government has founded an inoculation station where animals are inoculated in order to protect them from the more dangerous diseases. Up to the present, many thousands of cattle have been successfully treated, to the great satisfaction of the natives. Further, the Government has issued regulations for the protection of grazing concessions (extending over 10 years) and the use of pastures. At Merca, a Stock-breeding Station (Stazione sperimentale d'incrocio e di selezione) has recently been established; it has already been supplied with different native breeds of cattle, and has set itself the task of finding out the best breeds, and the most suitable breeding methods. By a Decree of September 12, 1912, a department was instituted in the local colonial administration to take charge of stock-breeding (Direzione dei servizi zootecnici).

Stock breeders' tasks. — According to the writer, the chief aim of the stock breeder in Southern Italian Somaliland should be the production of meat for exportation to Italy. This is impossible at present, for the conditions requisite for obtaining a large supply of cattle are wanting. If, however, certain measures were carried out, the Colony would easily be able to make up the deficiency in the meat supply of the Motherland. Such measures would include:

1) The improvement of the breeds of cattle by means of selection, or methodical crossing, and the changing of the grazing methods of the natives.

2) The establishing, in one of the coast towns of the Colony, of a Society with large capital, which would be in a position to take over the cattle and meat trade.

3) The improvement of the communication with Italy and the providing of the ships with cold-storage chambers for meat.

The Government, on its side, must take effective measures for the control of diseases. This will be best done by turning the Inoculation Station into a modern institute for serum preparation, and making a quarantine station on the coast. In addition, the writer requires that the Government should create a bureau of information on stock breeding and an experimental stock farm, mainly for the assistance of the Italian colonists, who are still few in number.

Lastly, the writer counsels the acquisition of only large ranches, say 25 000 acres, which should be devoted to meat production. According to

careful calculations, such a farm, after a few years, could supply annually to the meat market at a high profit 400 head of cattle and 1000 lambs. The production-cost per 100 lbs. of meat would be about *22s 9d*, that is relatively little.

358 - **The Condition of the Breeders' Associations in Germany in 1912.** — KNISPEL, OSKAR in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 28, No. 51, pp. 687-690. Berlin, December 20, 1913.

The following tabular summary gives the objects and number of the Breeders' Associations in Germany, the number of registered animals and the numerical increase (+), or decrease (—), for the year 1912.

TABLE I.

Breeders' Associations for:	Number of Associations	Animals registered	Increase (+) or decrease (—) in the animals of 1912 as compared with the preceding year
Horses	246	65 187	+ 1 553
Cattle	1 627	410 953	+ 12 938
Sheep	9	4 542	— 31
Pigs	171	19 729	+ 1 452
Goats	916	55 108	+ 7 655
Total	2 969		

In comparison with the preceding year, 1912 shows an increase of 293 associations, of which 16 are devoted to horses, 45 to cattle, 1 to sheep and 235 to goats; the pig-breeding associations have decreased by 4.

The largest number of registered horses is to be found in Hanover, where 9 658 head are entered. Schleswig-Holstein takes the lead as regards cattle, with 54 362 registered, while Brandenburg heads the list for sheep, with 3 040 and Hanover for both pigs and goats, with 6 916 and 20 559 respectively.

The registered animals all belonged to the following breeds:

TABLE II.

Division and Breed.			*Number of Animals.*
Horses	German Thoroughbreds	stallions	1 985
		mares	42 432
	Draught horses	stallions	712
		mares	20 058

Division and Breed.			*Number of Animals.*
Cattle	Mountain cattle	bulls	10 297
		cows	118 380
		heifers	14 325
	Lowland cattle (including Shorthorns)	bulls	14 212
		cows	239 545
		heifers	14 194
Pigs	German Improved pigs	boars	333
		sows	1 856
	unimproved native pigs	boars	94
		sows	340
	improved native pigs	boars	2 974
		sows	13 817
	other breeds	boars	42
		sows	273
Goats	White Saane breed	males	1 942
		females	31 596
	Coloured breeds	males	597
		females	21 071

359 - **Calf-Feeding with Blatchford's Calf Meal.** — GIULIANI, RENZO in *Annuario della Istituzione Agraria Dott. Andrea Ponti*, Vol. II, pp. 37-50. Milan, 1914. CATTLE

Blatchford's Calf Meal is a greyish red, not very homogeneous meal with a pleasant favour; it contains 45.84 per cent. of nitrogen-free extract and 20 per cent. digestible protein. It is the product of an American firm, and is offered as a substitute for milk in rearing calves ; 1 lb. of the meal in one gallon of water is regarded as the equivalent of one gallon of milk.

The writer has lately carried out a rearing experiment at the Agricultural College at Milan upon five Bergamasco calves from six to twelve days of age, in order to ascertain how far this substitute can actually replace milk. The animals were, for this purpose, divided into two lots; lot I consisted of two calves, and lot II of three. The calves were fed as follows:

Period	Lot I	Lot II
first	milk	milk
second	milk + meal	milk + meal
third	meal	milk (2 calves); milk + meal (1 calf).

In lot I, 1lb. of meal in a gallon of water was substituted for a gallon of milk, while in lot II the amount was 2 lbs. of meal in a gallon of water. In the third period, the experimenter had intended to entirely replace the milk (also in the case of lot II), but already at the close of the second period the calves refused the food, so that two of the animals were again given milk, while the third was fed as before. The rations were always measured according to the appetite and the live weight of the calves. The experiment lasted 57 days in the case of lot I and 90 days in that of lot II.

Results: the health of all the animals was very good throughout the first, or milk, period. The same may also be said regarding the first part of the second, or mixed food, period. But the more milk was subsequently replaced, the greater the loss of appetite shown by the animals. The calves of lot I only readily took up to 21 oz. of meal, and those of lot II refused to eat more than 28 oz. In the third, or meal, period the appetite of the calves of lot I decreased so much, that it was necessary to change the feeding after a few days to prevent death. It was found impossible to substitute meal entirely for milk in the case of lot II. During the time that they were fed on meal, the calves were low-spirited and out of sorts and suffered from attacks of shivering and diarrhoea. The urine and faeces were evacuated in larger amounts than usual; the faeces were always coloured, and contained particles of undigested meal. If the animals were again given milk, they regained their usual appearance after a few days. In the case of both lots, the live weight decreased with the increase of the meal ration.

The results of the experiment lead to the conclusion that Blatchford's Calf Meal cannot entirely replace milk, either from the physiological or the economic point of view. Physiologically, though not economically, it can be used with success under some circumstances as a partial substitute for milk.

360 - **Studies of the Irish Kerry Cow.** — FUNDWALL, E. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. 2, Part 2, pp. 331-374. Vienna, November 29, 1913.

The writer first gives a detailed description of the climate and soil of Ireland, and then speaks of the distribution, feeding, management, breeding and performance of the Kerry cow. He then proceeds to describe the Dexter, and subsequently gives the measurements of 19 typical skulls, comparing the measurements with those of the skulls of the red Breton and Polish breeds. In the last chapter, the writer gives a summary of the history of the Kerry cattle.

The study of the skull and body measurements of the latter revealed their almost complete agreement, in these respects, with the *brachyceros* red Breton and Polish breeds. The *brachyceros* characters were far more marked in most of the Kerry skulls examined than were the *primigenius* characters. The latter characters were generally only recognizable in the formation of the forehead, the shape of the nasal and lachrymal bones, and that of the temporal fossae.

The conclusion to be drawn is that the Kerry cattle are very nearly related to the red Breton and Polish breeds, and consequently, like these, do not belong either to the *primigenius* or the *brachycephalus* (Werner) group but should be included in the *brachyceros* group.

361 – **The Distribution of the Wild Sheep in relation to Watersheds.** – KOWARZIK, RUD. in *A. Petermann's Mitteilungen aus Justus Perthes' Geographisches Anstalt*, Year 60, February Number, pp. 70-72. Gotha, 1914. SHEEP

The writer shows that the distribution of the 50 forms of wild sheep in the Holarctic region is largely according to river-basins, watersheds forming the limits between the areas of neighbouring forms.

362 – **Pig Feeding Experiments.** — MEYER, G. and FINK, E. in *Sonderabdruck aus Mitteilungen der Vereinigung Deutschen Schweinezüchter*, 6 pages. (undated). PIGS

In the year 1913, at the suggestion of the "Vereinigung Deutscher Schweinezüchter", a ten weeks' feeding experiment with 260 pigs of the improved local breed, weighing uniformly about 148.5 lbs., was conducted, with the chief object of judging the relative value of dry and moist feeding (1). The animals, which were fed according to their appetites, were divided into thirteen lots of twenty each. The dry food was supplied by a Thimann's dry food automatic feeder; the moist food was given as a stiff paste.

The results of the first eight lots, in which four different mixtures of food were compared with each other, are shown in Table I.

In this table only the cost of the food is considered; all the other factors, such as cost of management, rent of sties, as well as the value of the manure produced, have been omitted.

TABLE I.

Food given	Fed moist				Fed dry			
	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase
	per day, per pig				per day, per pig			
	lb.	lb.	*d*	*d*	lb	lb	*d*	*d*
$^1/_3$ Axa, (*) $^1/_3$ barley groats, $^1/_3$ potato flakes + blood meal	0.93	4.27	3.6	3.9	1.03	4.95	4.2	4.1
Barley groats, Fattinger's grain blood food .	0.96	4.87	4.1	4.2	0.96	5.13	4.3	4.5
Barley groats, blood meal	0.99	4.81	3.9	4.1	0.91	5.03	4.2	4.6
Barley groats, fish meal	0.89	4.85	3.9	4.4	1.00	5.74	4.8	4.8
Average . . .	0.94	4.66	3.8	4.1	0.97	5.21	4.3	4.5

(*) A preparation of maize.

(1) See No. 1270, *B.* Nov. 1913. (*Ed.*)

With the dry food, the price of increase of live weight costs a trifle more than with the moist food, but on examining the records of the separate weeks it is found that in some weeks dry feeding was more advantageous and in others moist. The final result is not therefore absolutely reliable, as it would have varied had the experiment been stopped at another date. Nevertheless it may be stated that the two ways of feeding cost about the same. As for the mixtures of food, the writers observe that the first mixture seemed to suit the pigs particularly well, though the others all caused a normal development of the animals.

Table II contains the results of the five remaining lots, in which five different food mixtures were compared. The first four mixtures were given moist and the fifth dry.

TABLE II.

Food given	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase
	per day and per pig			
	lb	lb	*d*	*d*
Axa and blood meal.	0.63	4.22	3.6	5.7
1/2 Axa, 1/2 barley groats + blood meal.	1.42	5.19	4.3	4.2
1/3 Axa, 2/3 barley groats + blood meal	0.98	5.06	4.2	4.3
1/4 Axa, 1/4 barley groats, 1/2 potato flakes + blood meal.	0.93	4.42	3.7	4.0
Barley groats and dry yeast	1.14	5.41	4.4	3.9

The mixture of Axa + bloodmeal was not a great success; the animals did not seem to relish it much and remained inferior to the others. On diminishing the amount of Axa fed, the animals showed more appetite. As regards the other mixtures, it is to be noted that potato flakes always produced after a short time a feeling of satiety, and that dried yeast, though at first not willingly taken, proved a good and wholesome food.

At the butcher's test no difference could be detected between the flesh of the pigs that had been fed dry food and the flesh of the others. Too much Axa food made the fat softer and slightly yellowish.

POULTRY.

363 - **Early Identification of Good Hens.** — WILSON, J. (Royal College of Science, Dublin) in *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XIV, No. 2, p. 240. Dublin, January 1914.

An important observation has been recorded in connection with the egg-laying competition at the Munster Institute (Cork). It was found that a hen's total egg yield for the year could be predicted from her performance during the first eight or ten weeks of the laying season (November, December, January). Good layers laid about five eggs a week, very seldom

Schuman sun power plant.

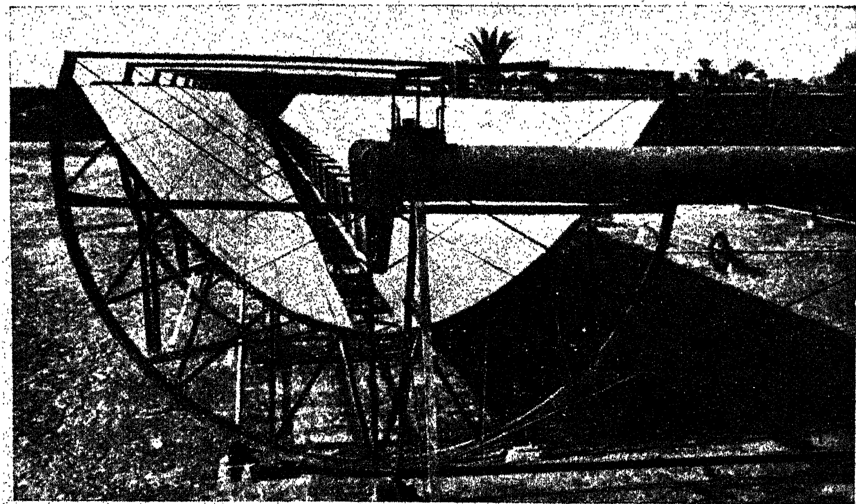


Fig. 1.

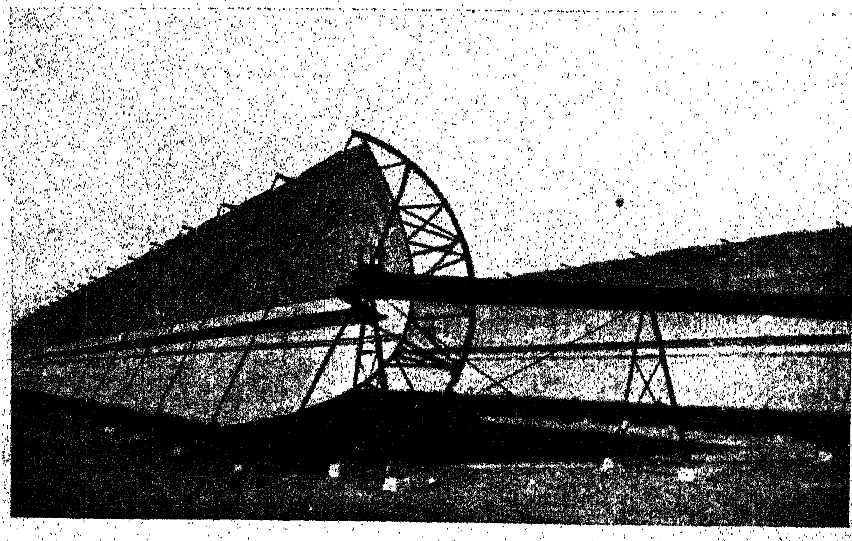


Fig. 2.

having two successive blank days, and continued at this rate for eight or ten weeks. Medium layers had blanks of several days at a time, or did not give a continuous steady yield during the same eight or ten weeks, while bad layers laid very few or no eggs during the period.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

364 - **The Shuman Sun Power Plant.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 467, pp. 1515-1517. London, March 1, 1914.

The direct utilisation of solar energy for the production of mechanical power has long presented an interesting problem. One practical solution to it has been found by Mr. Frank Shuman of Philadelphia, who has been at work upon it for the last seven years. He has now in operation near Cairo, Egypt, the sun-power irrigation plant shown in the accompanying illustrations.

It consists primarily of five heat absorbers, a 100 HP low-pressure condensing engine and a reciprocating pump. Fig. 1 is a view of one of the heat absorbers and Fig. 2. shows two of them in a tilted position. The absorbers carrying the boilers are set due north and south on rollers and gears on concrete foundation posts, and are slowly turned so as always to face the sun. They are 200 ft. long, and 13 ft. wide at top, and consist of light parabolic frames set with silvered mirrors which catch and reflect the heat of the sun on to the long flat-bottomed boilers suspended in the line of foci of the mirrors. The steam, which is not allowed to rise above one atmosphere pressure, is collected by a 3 ½ inch pipe running along the whole line, whence it is conveyed to the engine by the main steam pipe. After doing its work the steam in the engine is condensed into water and pumped again into the boilers; the danger of clogging the boilers with mud or scale is thus minimized.

The cost of power production by this system is claimed to be equivalent to using coal at 9*s* 8*d* per ton, whilst in Egypt and the Sudan the price of coal is given as over £ 3 per ton.

365 - **New Rotary Tilling Machine: The "Motoculteur."** — *Les Inventions Illustrées*, Year 17, No. 2, p. 7. Paris, January 20, 1914.

The main feature of this machine is a rotary digger with flexible claws. Its advantages are lightness, great facility of management, and the uniform and complete working of the soil at one operation.

The following are the official returns of crops grown at Grignon on land worked by this machine:

	Total weight	Straw	Grain
	lbs.	lbs.	lbs.
With 178 lbs. of seed per acre	8080	5590	2490
» 107 » » » » »	9150	6650	2500

This machine, destined for vineyards and market gardens, is built by the "Société de la Motoculture Française" in Paris.

366 - **The "Detroit" Rein-Steerage Gasoline Tractor.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 467, p. 1520. London, March 1, 1914.

Great economy of agricultural labour is effected by several recent machines ; thus some motors and binders have been built, two of which can be driven by one man.

Recently the Detroit Tractor Co., Detroit, Michigan, U. S. A., have built a tractor which is controlled by the man sitting on the reaper, plough or whatever implement is being operated, the tractor being driven, like a team of horses, by reins.

The steering is accomplished by a pull on the right or left steering rein. A pull on both reins stops the engine. The third rein moves the gears from a neutral position to "forward" or "back" and, exceptionally, in hilly country, a fourth rein is used to work the brake.

367 - **Ditch-Excavating Machine.** — *Engineering Record*, Vol. 69, No. 1, p. 4. January 3, 1914.

The F. C. Austin Drainage Excavator Company of Chicago have built a ditching machine which cuts ditches of 5 ½ feet maximum depth with a 5 foot bottom. The sides are cut with a 1 : 1 slope so that the maximum top width possible is 16ft. The traction is so designed as to permit the machine to turn a complete circle with one wheel stationary. The outfit illustrated is worked by a 50 HP gasoline engine. In ground composed of dry alluvial soil the machine is claimed to have excavated 175 cu. yds. per hour. The cost of operation is about $ 15 per day. The outfit can be operated by one man.

368 - **New Machine for Renovating Grass Lands.** — FRANK in *Georgine, Land- und Forstwirtschaftliche Zeitung*, Year 7, No. 6, p. 33. Königsberg i Pr., January 17, 1914.

Old or thin meadows are sometimes renovated by lightly working their surface with tooth or disk harrows or similar implements and then broadcasting grass seeds over them. Hitherto no implement existed which combined the least injury to the existing turf with the guarantee that all the seed cast reached the seed bed.

Such an implement, which may be called a «furrow-drill for grassland», has now been constructed and patented in the German Empire under No. 261 242.

The feeding shaft is driven by an endless chain on the hub of the right rear wheel. It is thrown into or out of gear by a clutch. The quantity of seed is controlled by a feed regulating device which allows a range of from 5 ½ to 22 lbs. of seed per acre. The furrow-openers and coulters are raised or lowered by a hand lever as in cultivators. The furrow-openers are fastened to a strong support, so that, as is shown in fig. 1 (in which *a* is the furrow-opener, *b* the coulter), they penetrate to a depth of only 1.2 inch into the soil, while the coulters cut 2 to 2 $^3/_4$ inches deeper ; thus the seed does not descend too deep into the soil and yet the latter is loosened to a greater depth and prepared for the reception of new roots. Experiments have shown that the seed drilled with this machine germinated very well. The drills are situated 5 ½ inches apart. In some cases where thick sowing is desirable the grassland can be drilled a second time cross-wise to the first drilling.

According to the depth of the work done, two or three medium horses are required to draw the machine, and 10 to 12 acres can be sown in

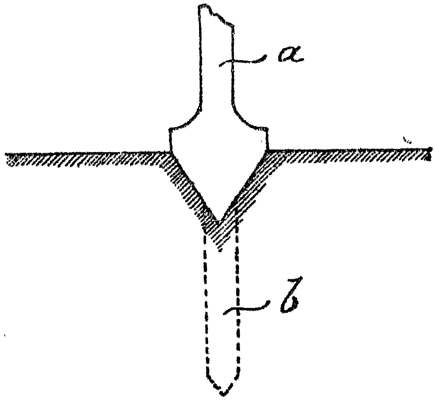


Fig. 1.

Grassland renovator. — Furrow-opener.

10 hours. Compared with other methods of renovating grasslands this implement saves much labour and seed.

The machine is built and sold by the Cooperative Machine Association at Konigsberg.

369 - **A New Appliance for Elevating Grain and Granular Goods.** — GREINER, W. in *Zeitschrift des Vereines Deutscher Ingenieure*, Vol. 58, No. 4, p. 154. Berlin, January 24, 1914.

The new flexible metal tubing invented by Jacob Bros., of Zwickau i. S., differs essentially from the metal tubing hitherto used; the latter cannot be used everywhere because its inside presents depressions or grooves in which some of the stuff conveyed lodges, and thus increases the resistance to the passage of the bulk of the same.

This new tubing is formed by two special steel or bronze bands wound spirally and forming an outer and an inner pipe. The inside of the latter is a succession of overlapping smooth surfaces. As packing, an asbestos cord is wound round the tube. According to experiments, this tube allows the passage of about 30 per cent. more grain than the old types in the same time, and its duration is four to six times greater. The various lengths of tubing can be joined to each other by flanges or conical couplings. The tubing is manufactured in various sizes, the largest reaching 20 inches in diameter. For elevating grain or the like from the holds of ships it is made especially light so as to be very flexible.

Figure 1 shows a side view of a piece of tube, Fig. 2 a section and Fig. 3 the tubing at work.

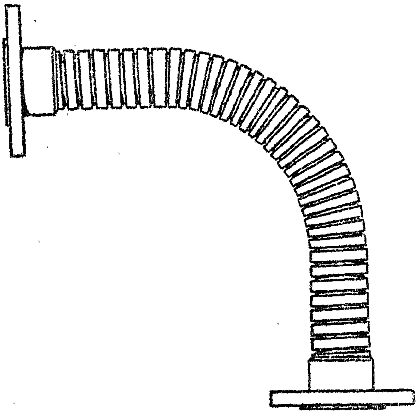


Fig. 1.

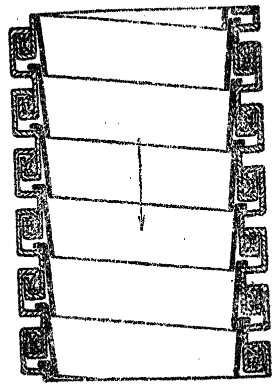


Fig. 2.

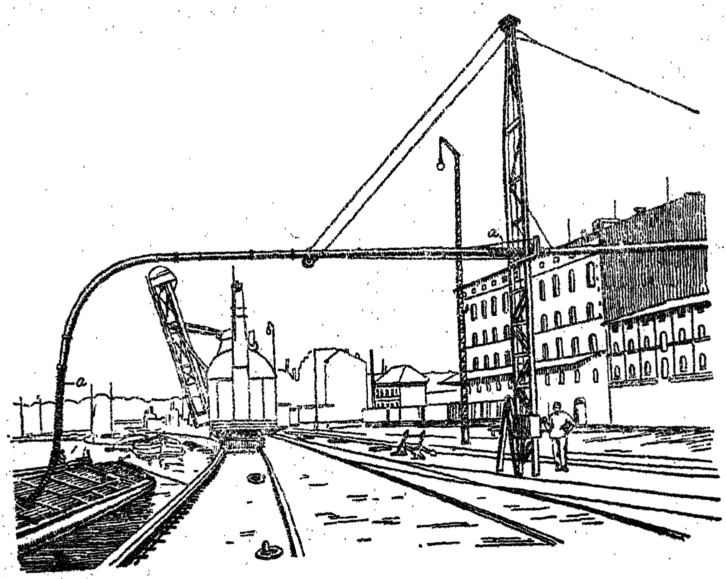


Fig. 3.

Grain elevator.

370 – **Process and Apparatus for the Extraction of Sugarcane Juice.** — MENGELBIER, O. in *La Sucrerie indigène et coloniale*, Year 49, No. 1, pp. 3-7 + 2 figs. Paris, January 7, 1914; and Patent N. 549748.

The writer has invented a process and an apparatus for the improved extraction of sugarcane juice by means of mills. The invention consists of:

1. A process of extraction, the characteristic feature of which is that the bagasse is first treated by steam (preferably in a chamber allowing of

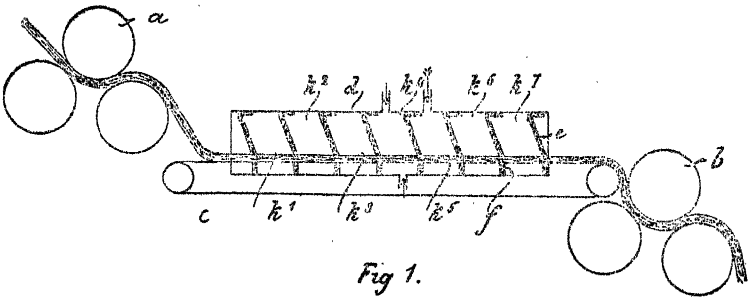


Fig 1.

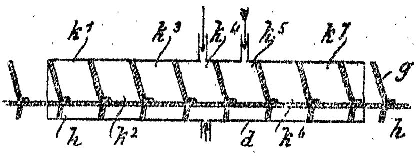


Fig 2.

Apparatus for the extraction of sugar-cane juice.

a certain pressure above that of the atmosphere so as to attain the temperature required to burst the cells of the outside layers of the cane and of the hard knots), and then, in another chamber, supplied with the quantity of diffusion liquid that is still necessary.

2. An apparatus for carrying out the process, the principle of which is that the bagasse is conveyed between two pressings through a chamber which is as air-tight as possible.

3. A detail of the apparatus consisting in placing before and behind the principal compartments one or more compartments in which the steam that escapes may condense upon the bagasse. This is done to avoid the losses of steam due to the chamber not being sufficiently air-tight.

The accompanying figures show one form of the chamber consisting of several compartments k^1 to k^7; *a* and *b* are sets of rollers, *c* is an endless

canvas conveyor or similar device for carrying the bagasse through a channel-shaped vessel *d*. In order to obtain approximately air-tight chambers, shutters or partitions (*e, f*, fig. 1; *g, h*, fig. 2) are used; they may be rendered more air-tight by rubber strips or other similar material. In fig. 1 the partitions (*e* and *f*) are borne by the vessel *d*, while in fig. 2 they (*g* and *h*) are carried by the endless conveyor and rub against the sides of *d*.

Steam is introduced into the chamber k^4, where it warms the bagasse and penetrates into it; part of the steam is condensed and part escapes into the neighbouring compartments k^3 to k^1 and k^5 to k^7. In the former it comes in contact with the cold bagasse, which it warms, while the steam which gets into compartments k^5 and k^7 is condensed by the imbibition liquid which is introduced into k^6 and which is preferably already strongly heated; this liquid, together with the condensed steam, causes the sugar to diffuse out.

371 – **Simon's "Star" Sack Cleaner.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 465, p. 1211. London, January 1, 1914.

Sacks being employed in vast numbers, some wholesale mechanical method of cleaning them is often required, and in such cases the Star Sack Cleaner, shown in the accompanying figure (made by Messrs. Henry Simon Ltd., Manchester) appears to be invaluable. The sacks, 100, 200 or 300 at a time according to the size of the machine, have simply to be thrown into the revolving chamber. The sacks are not fixed or held in any way, but are tumbled about inside the drum, and after half an hour are cleaned unless caked inside, in which case they require turning. The dust and dirt leave the machine through a wire screen round the drum.

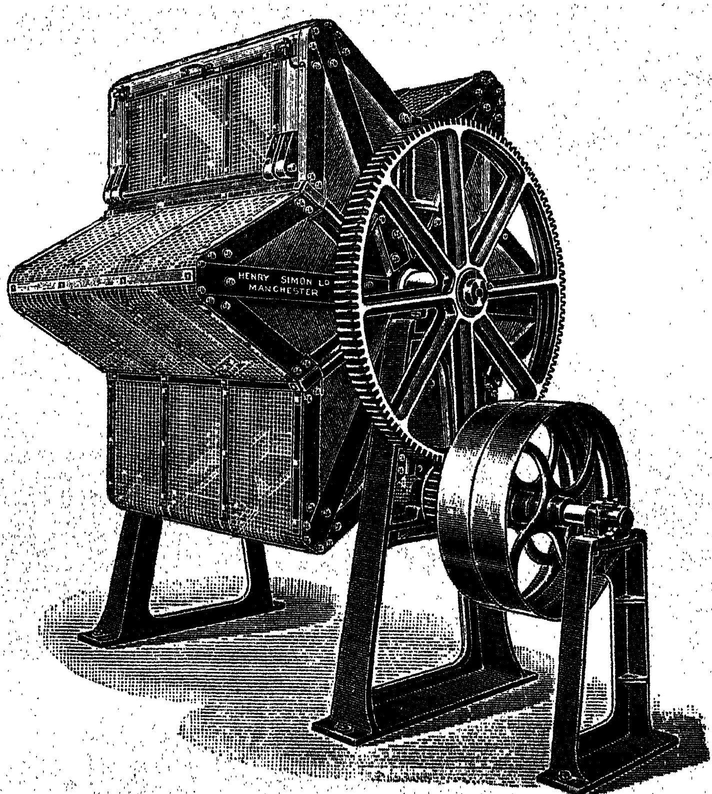
These cleaners have been adopted by many large flour mills and other establishments which use sacks. They are built in three sizes. The lengths of the machines are 5, 7 and 9 feet respectively. The gross weights are 55, 60 and 70 cwt. The width and height of the machines are the same for each size, namely 8ft. 6 in. by 10 ft. 7 in.

372 – **A New Cattle Cart.** — *Deutsche Schlacht- und Viehhofzeitung*, Year 14, No. 5 p. 68. Berlin, February 1, 1914.

The cattle cart shown in the accompanying figure is so constructed that its back can be let down so as to form a bridge for loading or unloading cattle. In the same way the two front halves of the sides of the truck can be let down as bridges; these bridges can also be placed in the doorway of a railway cattle truck, so that the animals can go straight in from the cart.

373 – **Mechanical Requisites in Cyprus** — *The Implement and Machinery Review*, Vol. XXXIX, No. 467, p. 1500. London, March 1, 1914.

The tillage implements used in Cyprus have hitherto been of the most primitive type. The Agricultural Department of Cyprus has been trying to introduce modern appliances by practically giving implements to some growers or by hiring out machines under easy conditions. As soon as the growers were able to judge of the value of new farm requisites, the Department withdrew from the market and left the trade to makers and agents. As a result of this policy the imports of these articles have grown rapidly



Simon's "Star" sack cleaner.

and in 1912 they amounted to £ 1175. The bulk of the trade is in English hands, but ploughs have been shipped from Russia and other implements from Germany and Austria.Some reapers and binders and threshing machines have been introduced, and wind engines are employed freely for irrigation purposes. On the whole the country offers good promise for the future.

374 – **Review of Patents.**

Tillage implements and machines.

63 394 (Austria). Adjusting device for fore-carriages of cultivators and the like.
64 241 (Austria) Hoeing apparatus for agricultural motors.
64 243 (Austria). Appliance for increasing the adhesion of driving wheels in ploughing machines.
64 245 (Austria). Steering gear for ploughing machines with steering wheel.
261 179 (Belgium). Process for treating sandy and dry soils previous to cultivation.
262 120 (Belgium). Regulator for inclination of simple and double Belgian ploughs.
262 240 (Belgium). Handle attachment which can be applied to double Belgian ploughs.
460 148 (France). Planting and hoeing machine.
460 572 (France). Arrangement for shifting laterally the beams and shares of ploughs.
461 246 (France). Improvements in tilling machines.
461 267 (France). Motor plough.
461 283 (France). Cultivator.
463 512 (France). Improvement in double and single ploughs applicable to revolving or fixed beams.
269 517 (Germany). Motor plough with cleated wheels.
269 717 (Germany). Wheel with adjustable cleats for agricultural motor machines.
269 719 (Germany). Motor plough.
270 902 (Germany). Multiple-furrow gang ploughs.
271 493 (Germany). Cable with laterally adjustable rollers for motor balance-ploughs.
271 521 (Germay). Motor plough with rear steering wheel.
271 713 (Germany). Wheel with shovel ceats for motorcar for agricultural machines.
17 569 (United Kingdom). Land levelling appliance.
1 086 427 (United States). Plough attachment.
1 086 449 (United States). Attachment for cultivators.
1 086 761 (United States). Cultivator.
1 086 860 (United States). Gang plough.

Manure distributors.

64 244 (Austria). Device for regulating the quantity of manure spread by manure spreaders.
269 394 (Germany). Manure spreader.
269 863 (Germany). Manure spreader.
270 734 (Germany). Farmyard manure spreader.
270 801 (Germany). Nitrate of soda spreader.

Drills, sowing machines and planters.

460 569 (France). Change of speed for drills.
271 659 (Germany). Combined drilling and dibbling wheel.
1 086 511 (United States). Corn planter.
1 087 010 (United Srates). Cotton planter.

Mowers, reapers and harvesters.

461 372 (France). Attachment for raising the ears in harvesters and similar machines.
461 380 (France). Mower.
463 365 (France). Automatic mower.
269 353 (Germany). Three-wheeled sheaf binder.

24 872 (Germany). Harvesting machine.
25 152 (United Kingdom). Reaping or mowing machine.

Machines for lifting root crops.

64 050 (Austria). Potato harvester.
64 300 (Austria). Potato harvester.
262 259 (Belgium). Apparatus for topping beets.
262 271 (Belgium) Device for automatic raising and lowering of beet lifters.
261 789 (Belgium). Device for topping, lifting and carting beets, etc., and at the same time ploughing the soil.
24 737 (United Kingdom). Potato harvesters.
1 086 631 (United States). Beet harvesters.
1 086 563 (United Kingdom). Potato harvest machine.

Other agricultural machines and implements.

461 113 (France). Appliance for bimetallic sprayers.
461 403 (France). Apparatus for removing the upper layer from honey-combs.
460 417 (France) Instrument for cutting bunches of grapes.
460 659 (France). Forage drier.
269 354 (Germany). Hay tedder convertible into swathe rake.
269 482 (Germany). Differential steering for fore-carriages.
269 573 (Germany). Hummeller.
270 841 (Germany). Straw press binder with two pincer-like groups of arms working together.
271 753 (Germany). Automatic wire binder for straw presses and the like.
25 000 (United Kingdom). Cow milkers.
25 063 (United Kingdom). Grinding, crushing and cleaning grain.
25 275 (United Kingdom). Fermenting vats.
25 279 (United Kingdom). Hedge trimmers.
24 595 (United Kingdom). Cooling milk.
24 601 (United Kingdom). Separating apples.
24 614 (United Kingdom). Cracking nuts, seeds, etc.
24 771 (United Kingdom). Protecting orchards from frost.
24 816 (United Kingdom). Destroying weeds.
1 086 597 (United States). Hay loader.

RURAL ECONOMICS.

375 – **A Farm Management Survey of Three Representative Areas in Indiana, Illinois and Iowa.** — THOMSON, E. H. and DIXON, H. M. in *Bulletin of the U. S. Department of Agriculture*, No. 41, pp. 42. Washington, January 14, 1914.

In the year 1911 the office of Farm Management of the Bureau of Plant Industry, United States Department of Agriculture, made a farm management survey of 700 farms, the results of which are given and discussed in the present paper. Three districts, one each in Indiana, Illinois and Iowa, were selected for the farm management study; in choosing the areas an effort was made to have as uniform farm conditions as possible in each region and representative of the agricultural conditions prevailing over a large area. The farms examined were 277 in the first State and 196 and 227 in the other two States respectively.

In Illinois and Indiana weather conditions were about the average, while in Iowa, owing to a drought in early summer, the results were about

20 per cent below the average. The data were obtained by having trained investigators to visit the farmers personally.

The writers examined first the effect of the form of management, and divided the farms into four groups: those operated by the owners, those worked by tenants, those owned by a farmer who rented additional land and those rented from two or more landlords, they then calculated the incomes yielded by these various groups. (See Table I).

The labour income of farmers who operate their own farms is very moderate. For the amount invested the tenant's income is very much greater than that of the farm owner, though the absolute total income of the latter is greater owing to the interest on the large capital. The evidence is unmistakeable that the man with small capital should rent rather than buy a farm. The third group, namely of owners who rent additional land, show a better labour income than that of owners; this is explained by the fact that they utilize better their labour and their teams and receive greater returns without any appreaciable increase in investment. Calculating the rate of interest on the capital invested in farms operated by the owners at 3.5 per cent. instead of 5 per cent., the former being in fact the rate of interest obtained by the owner of rented farms, an average labour income of $870 to the operator, whether owner or tenant, may be expected. The farms in the three States yield for an average size of 175 acres an average labour income of $870 and an interest of 3.5 per cent. on the capital invested.

The labour income of farmers who run their own farms varies from below $500 to upwards of $2000. In order to show that the causes of these great differences depend mostly upon the varying activity of the farmer and less upon the size of the farm and the amount of capital invested, the farms are grouped in Table II according to the labour income they yield, compared with the capital, area, expenses, and receipts per acre.

From Table II it will be seen that the largest farms and the greatest capitals are in the hands of those farmers who have obtained on the one hand the best results, and on the other the worst.

If on the contrary the capitals of the tenants are compared with their labour income, it appears that almost without exception the tenant's income is in direct proportion to the sum he has invested, while the amount of capital has no connection with the rate of interest on the capital invested by the owner. (See Table III).

In order to study the influence of the size of the farm on the cost of labour, the writers group the 700 farms according to size and calculate for each the cost of labour, the number of draught horses, the crop area per horse and the capital invested in machinery. (See Table IV).

On farms of 40 acres and less the cost of labour is over $10 per crop-acre. On all farms above 120 acres the cost is less than $6 per crop-acre. Large farms also utilize better their horse labour; on farms of 240 acres one horse works two and one-half times as much land as on a 40 acre farm. The same laws which govern the use of farm labour apply

to machinery; thus, while in the smallest farms the value of the machinery is \$5.4 per crop-acre, in the largest it ranges from \$2.15 to \$1.42. That labour in the larger farms, in spite of the greater area per unit of labour,

TABLE I.

	Operated by owners				Tenants		
	Indiana	Illinois	Iowa	Average	Indiana	Illinois	Iowa
Number of farms	123	73	77	total 273	83	71	93
Average area . . . acres	105	253	176	178	128	202	187
Average capital . . . \$	17 535	51 091	23 193	30 606	1 758	2 867	2 667
Receipts . . . »	1 876	5 042	2 308	3 076	1 335	2 257	1 605
Expenses . . . »	689	1 866	858	1 138	492	975	755
Farm income . . . »	1 187	3 176	1 450	1 938	843	1 282	850
Interest at 5 p. cent . . . »	877	2 554	1 159	1 530	88	143	134
Owner's labour income . . . »	310	622	291	408	755	1 139	716

TABLE II.

Labour income	Number of farms	Average size — acres	Average crop area — acres	Average capital — \$	Pe[r] Real estate
—\$500 and more	26	267	199	46 582	89.7
—\$499 to —\$200	23	160	117	25 933	89.2
—\$199 to \$0	40	102	77	16 883	88.5
\$ 1 to \$ 200	53	120	95	19 753	89.6
\$ 201 to \$ 400	34	139	96	20 435	86.7
\$ 401 to \$ 600	23	161	118	27 986	86.8
\$ 601 to \$ 800	20	184	140	30 158	86.6
\$ 801 to \$1000	13	217	160	35 082	89.8
\$1001 to \$1500	19	201	169	32 658	88.2
\$1501 to \$2000	10	249	179	46 573	83.7
over \$2000	12	330	140	55 625	85.1

is utilized with about the same intensity as in the small farms is shown by Table V, in which the relation of the farm to the yield of the various crops is given.

TABLE I.

Operated by tenants					Operated by owners renting additional land			
	Landlords							
Average	Indiana	Illinois	Iowa	Average	Indiana	Illinois	Iowa	Average
total 247	83	71	93	total 247	56	36	37	total 129
172	128	202	187	172	—	—	—	105 + 78
2 431	18 423	36 479	20 728	25 210	11 321	32 382	17 829	20 510
1 732	1 002	1 538	1 014	1 185	1 780	4 279	2 228	2 762
740	351	213	354	306	742	1 599	887	1 076
992	651	1 325	660	879	1 038	2 680	1 341	1 686
122	3.53 %	3.64 %	3.19 %	3.5 %	566	1 619	891	1 025
870	—	—	—	—	472	1 061	450	665

TABLE II.

centage in			Distribution per acre				
Machinery	Stock	Supplies	Receipts — $	Expenses — $	Farm income — $	Interest — $	Labour income — $
1.2	6.7	2.4	10.98	5.97	5.01	8.74	—3.73
1.1	7.4	2.3	12.02	5.92	6.10	8.16	—2.06
1.2	7.7	2.6	12.94	5.53	7.41	8.30	—0.89
1.4	6.7	2.3	14.84	5.70	9.14	8.31	0.83
1.7	9.1	2.5	14.98	5.37	9.61	7.42	2.19
2.0	8.2	3.0	17.80	5.79	12.01	8.78	3.23
1.3	8.9	3.2	17.13	5.16	11.97	8.22	3.75
1.2	6.9	2.1	16.77	4.51	12.26	8.14	4.12
1.4	8.0	2.4	19.18	5.00	14.18	8.23	5.95
1.0	11.7	3.6	25.79	9.60	16.19	9.31	6.88
1.0	11.0	2.9	25.46	7.14	18.32	8.46	9.86

TABLE III.

	Tenant's capital $	Number of farms	Tenant's average capital $	Tenant's labour income $	Landlord's average capital $	Landlord's income on investment per cent
Indiana	500 and less	5	324	328	9 492	4.0
	501 to 1 000	13	750	312	9 940	2.9
	1 001 to 1 500	18	1 263	506	12 829	3.1
	1 501 to 2 000	19	1 726	765	17 679	3.0
	2 001 to 3 000	18	2 381	1 051	22 130	3.6
	3 001 to 4 000	8	3 324	1 217	34 904	4.0
	4 001 to 6 000	2	4 770	2 322	54 088	4.4
	Total or average	83	1 758	755	18 425	3.5
Illinois	501 to 1 000	4	871	429	10 031	2.7
	1 001 to 1 500	10	1 262	614	23 737	3.5
	1 501 to 2 000	15	1 733	709	29 703	4.1
	2 001 to 3 000	18	2 482	1 054	36 948	4.05
	3 001 to 4 000	15	3 493	1 085	42 898	3.3
	4 601 to 6 000	4	4 828	1 732	50 950	3.6
	6 000 and over	5	9 011	4 117	70 750	3.1
	Total or average	71	2 867	1 139	36 479	3.6
Iowa	501 to 1 000	4	776	272	8 568	3.2
	1 001 to 1 500	16	1 288	387	13 808	3.0
	1 501 to 2 000	14	1 816	490	16 971	2.8
	2 001 to 4 000	30	1 455	639	19 374	3.0
	3 001 to 4 000	18	3 428	983	25 027	3.2
	4 001 to 6 000	8	4 825	1 334	31 490	3.2
	6 001 and over	3	8 303	1 641	50 412	4.7
	Total or average	93	2 667	716	20 728	3.2
Total or average for the three States.		247	2 419	850	24 482	3.4

TABLE IV.

Area	Number of farms	Average Crop area * — acres	Cost of labour per crop-acre	Average number of work horses	Crop area per horse — acres	Value of machinery: Total per farm	Value of machinery: per crop-acre
40 acres united . . .	45	26.4	$ 10.08	2.8	9.4	$ 133	$ 5.04
41 to 80 acres . .	114	56.7	7.28	3.6	15.7	241	4.25
81 » 120 »	120	86.0	5.57	4.5	19.1	279	3.24
121 » 160 »	130	122.4	4.89	5.8	21.1	345	2.82
161 » 200 »	93	143.4	4.74	6.6	21.7	413	2.88
201 » 240 »	75	184.9	4.69	7.8	23.7	452	2.44
241 » 280 »	35	211.2	4.40	8.4	25.1	718	3.40
281 » 320 »	37	233.8	3.98	9.5	24.6	561	2.40
321 » 400 »	30	298.0	3.88	10.8	27.6	747	2.51
401 » 560 »	12	368.6	3.88	13.1	28.1	690	1.87
561 » 720 »	5	555.4	4.41	19.4	28.6	790	1.42
721 » 1 250 »	4	612.0	5.29	19.0	32.2	1 313	2.15
Total or average . . .	700	142.8	4.63	—	—	383	2.69

(*) All tillable land except permanent pasture.

TABLE V.

Size of farms — acres	Indiana: Number of farms	Indiana: Yield per acre (bushels): Maize	Oats	Wheat	Illinois: Number of farms	Illinois: Yield per acre (bushels): Maize	Oats	Wheat	Iowa: Number of farms	Iowa: Yield per acre (bushels): Maize	Oats	Wheat
80 and less	92	50.2	44.4	19.0	12	60.4	43.0	16.0	26	33.2	32.0	—
81 to 160	75	52.9	47.5	19.2	42	52.3	37.5	15.2	73	36.3	33.0	—
161 to 320	39	52.8	47.0	19.4	70	52.4	39.7	15.8	71	37.9	33.9	—
321 and over	—	—	—	—	20	55.6	40.5	17.8	—	—	—	—
Total or average	206	52.1	46.6	19.3	144	53.3	39.3	16.5	170	37.0	33.5	—

In order to study the effect of the different type of farming on the profits, both the farms run by their owners and those rented are divided into crop farms, and live-stock farms, according to the prevalence of cropping or raising live stock, and the labour income is recorded. (See Table VI).

TABLE VI.

Operated by:	State	Live stock farms: Number of farms	Live stock farms: Area (acres)	Live stock farms: Permanent pasture (acres)	Live stock farms: Average capital ($)	Live stock farms: Labour income ($)	Crop farms: Number of farms	Crop farms: Area (acres)	Crop farms: Permanent pasture (acres)	Crop farms: Average capital ($)	Crop farms: Labour income ($)
Owners	Indiana . . .	95	103.2	5.6	17 405	348	28	113.0	2.0	17 981	182
	Illinois . . .	32	284.2	66.3	58 487	1 588	41	229.4	24.4	45 319	— 131
	Iowa.	67	181.2	40.1	23 775	329	10	140.9	17.1	19 296	34
	Total or average	194	189.5	37.3	33 222	755	79	161.1	14.5	27 532	28
Tenants	Indiana . . .	46	124	4	19 623	589	37	134	4	20 879	354
	Illinois	13	198	30	42 087	1 066	58	204	12	39 732	545
	Iowa	58	179	37	23 238	496	35	199	30	23 654	82
	Total or average	117	167	24	28 316	717	130	179	15.3	27 755	327

TABLE VII.

Operated by:	State	Live-stock farms: Number of farms	Live-stock farms: Yield per acre (bushels): Maize	Oats	Wheat	Crop farms: Number of farms	Crop farms: Yield per acre (bushels): Maize	Oats	Wheat
Owners	Indiana. . . .	95	52	47	20	28	51	49	18
	Illinois	32	60	43	17	41	51	36	18
	Iowa	67	37	35	20	10	42	35	—
	Total or average	194	50	42	19	79	48	40	18
Tenants	Indiana . . .	46	53	45	19	37	51	46	18
	Illinois . . .	13	59	42	15	58	51	39	15
	Iowa	58	35	31	17	35	37	34	—
	Total or average	117	49	39.3	17	130	46	39.6	16.5

The live stock farms, both those operated by the owners and those rented, yield a higher income than the crop farms. This is due primarily to two reasons: 1) That crop products, especially maize, fetch a higher price when fed to stock and converted into animal products than if sold on

the market; 2) the live-stock man utilizes his labour throughout the year, which the crop farmers do not.

It is commonly supposed that the live-stock farmers make greater profits owing to much better crop yields. That such is not the case is shown by Table VII.

Of the 247 farms operated by tenants, 58 were held on the cash-rent system and 189 on the share-rent system. A comparison of the income of the tenant and of the owner with both these forms of rental is shown in Table VIII.

TABLE VIII.

State	Cash- rent system					Share- rent system				
	Number of farms	Tenant's capital	Tenant's labour income	Landlord's capital	Returns on capital invested, per cent	Number of farms	Tenant's capital	Tenant's labour income	Landlord's capital	Returns on capital invested, per cent
		$	$	$			$	$	$	
Indiana	14	2 272	864	14 968	3.42	69	1 654	733	19 126	3.55
Illinois	18	3 118	1 440	28 771	2.50	54	2 788	1 044	38 906	3.89
Iowa	27	2 942	689	19 114	2.37	66	2 555	727	21 388	3.49
Total or average	58	2 777	998	20 951	2.76	189	2 332	835	26 473	3.64

Those who leased their farms on a cash basis received a much lower return then those on a share basis, as the risks are taken in the latter case by the tenant. From the tenant's point of view, in good years the cash rent system is the most profitable, while in bad years the share-rent system is better. In the State of Iowa, in the year for which the records were taken, owing to unfavorable weather conditions the crops were about 20 per cent. below normal, and the cash-rent tenants made less than those on a share basis.

The writers lastly study the connetion between the age and education of the farmer and his profits. They find that, especially among tenants, the older farmers are the least successful. This is explained by the fact that the younger and more capable tenants soon acquire sufficient funds to become owners, whilst the least capable are never able to save enough money to buy a farm; besides, landlords with good farms will not rent their land to them, and they are compelled to take the least desirable farms in the neighbourhood.

As for education, the investigations point to the fact that everywhere the men with the best training made the largest incomes.

376 - **Silesian Grazing Farms.** — WEITZ, G. in *Archiv für exakte Wirtschaftsforschung*, XII Supplement, 257 pp. Jena, 1913.

The writer gives in 13 complete descriptions a review of the natural and economic conditions of the management and arrangement, as well

Grazing farm	Year	Area of farm acres	Extent of pasture acres	Kind of stock (1)	Average number of grazing days	Increase of weight per head of large stock (2) lbs.	Head of large stock per acre for 150 days grazing	Produce per acre £ d s	Expense per acre £ s d	Net returns of pasture per acre £ s d
XI (3)	1908	117.1	117.1	90 Y	117	2.82	0.352	2 5 1	3 2 8	—0 17 7
»	1909	»	»	168 Y	142	2.23	0.737	4 8 1	3 7 11	1 0 2
»	1910	»	»	179 Y	119.6	2.28	1.676	4 2 6	3 7 2	0 15 4
XII (3)	1910	215.4	215.4	286 A 21 F	139	2.26	0.78	4 12 6	1 17 3	2 15 3
»	1911	»	»	341 A 18 F	107	2.04	0.51	2 15 6	1 15 4	1 0 2
II	1906	667	52	46 A 7 F	175	2.69	0.72	4 5 8	1 0 6	3 5 2
»	1907	»	52	40 A	164	1.90	0.65	3 5 6	1 7 7	1 17 11
»	1908	»	47	53 C	121	—	0.91	4 7 3	1 19 0	2 8 3
»	1909	»	47	50 C 3 F	144	—	1.08	6 7 0	1 18 2	4 8 10
»	1910	»	62	53 C	143	—	0.83	4 15 11	2 1 2	2 14 9
VII	1910	840	68	Varying:	140	1.68	0.62	4 7 9	2 4 10	2 2 11
VIII	1909	840	29.5	C, Y	113	2.10	1.41	7 11 10	2 3 2	5 8 8
»	1910	»	»	H, F	79	—	1.03	—	1 17 6	—
V	1908	844.6	29.5	Mostly Y.	140	3.57	0.97	6 14 9	3 2 5	3 12 4
»	1909	»	»	also	190	2.33	1.13	7 1 4	2 14 5	4 6 11
»	1910	»	»	F, C	197	1.37	1.62	5 19 9	2 10 7	3 19 2
»	1911	»	»	A, B	190	1.43	1.40	5 6 9	3 2 6	2 4 3
VI	1910	1188	43.2	62 Y 2 F	153.5	2.44	0.96	6 2 9	1 12 2	4 10 7
X	1909	1218	84.5	50 Y	143.6	2.42	0.30	1 18 4	1 11 9	0 6 7
»	1910	»	131	140 Y	146.2	1.44	0.45	1 15 0	2 6 0	—0 11 0
XIII (3)	1910	61.0	61.0	84 Y 7 F	104	1.45	0.66	2 14 1	0 14 8	1 19 5
»	1911	»	»	83 Y 13 F	118	1.62	0.77	3 7 2	0 14 8	2 12 6

(1) Abbreviations in this column: Y = young cattle, A = cattle, F = foals, C = cows, H = horses, O = Oxen,
(2) One head of large stock = 1000 lbs. live-weight.
(3) XI, XII and XIII are cooperative pastures.

Value of pasture per acre £ s d	Value of live stock £ s d	Total value per acre £ s d	Interest by net returns %	Cost of production: of 1 lb. live weight (Interest 4 % on capital invested) d	Cost of production: of 1 gal. of milk (Interest 4 % on capital invested) d	Value of farm per acre £ s d	Net reeturns of whole farm per acre £ s d	Gross returns of whole farm per acre £ s d	Interest on value of farm by net returns %
27 11 6	2 16 3	30 7 9	—	9	—	30 7 9	—0 17 7	2 5 1	—
»	5 18 0	33 9 6	3.10	5	—	33 9 6	1 0 2	4 8 1	3.10
»	5 8 6	33 0 0	2.32	5 1/4	—	33 0 0	0 15 4	4 2 6	2.32
33 7 0	6 2 9	39 9 9	7.60	3	—	39 9 9	2 15 3	4 12 6	7.60
»	5 11 0	38 18 0	3.00	5	—	38 18 0	1 0 2	2 15 6	3.00
35 14 0	5 15 0	41 9 0	8.34	2 3/4	—	43 13 0	1 5 4	5 17 10	3.47
»	5 3 9	40 17 9	5.13	4	—	»	1 4 6	7 9 0	2.80
»	7 6 3	43 0 3	6.07	—	4.57	»	1 4 1	8 9 7	2.76
»	8 13 0	44 7 0	10.46	—	2.92	»	1 10 4	5 17 10	3.47
»	6 12 9	42 6 9	6.94	—	4.27	»	1 4 6	7 9 0	2.80
27 2 9	4 19 0	32 1 9	7.29	3	4.71	35 14 3	1 15 2	5 12 4	4.92
40 18 6	11 6 6	52 5 0	10.30	2 1/2	3.11	31 14 9	1 9 2	—	4.59
»	8 5 3	49 3 9	—	—	—	»	1 9 2	—	4.59
55 11 0	7 15 9	63 6 9	5.71	3 1/2	—	62 5 6	4 1 2	8 19 10	6.52
»	9 1 9	64 12 9	6.72	3 1/4	—	63 17 6	3 2 3	9 5 0	4.88
»	13 1 9	68 12 9	5.16	3 3/4	—	63 17 6	4 3 3	8 18 4	6.52
»	11 4 6	66 15 6	3.31	4 3/4	—	»	—	—	—
65 5 0	7 13 6	72 18 6	6.47	3	—	40 6 0	0 7 5	6 9 7	0.93
33 5 0	2 7 6	35 12 6	0.93	6 3/4	—	40 4 3	—0 10 9	2 6 7	—
»	3 12 9	36 17 9	—	9	—	41 13 3	0 11 3	2 17 11	1.35
32 16 3	5 6 0	38 2 3	5.70	3 1/2	—	38 2 3	1 19 5	2 14 1	5.70
»	6 4 3	39 0 3	7.23	3	—	39 0 3	2 12 6	3 7 2	7.23

B = bulls.

as of the profitableness, of ten farms with grazing land and of three cooperative pastures, situated in different parts of Silesia; in these descriptions the grazing industry in its installation, operation and profitableness, is specially considered.

Lastly, with the aid of numerous comparative tables, he discusses the characters common to all these farms, and the points in which they differ from each other. The most important results of this investigations are given in the table on pages 528 and 529, for nine of the farms.

377 - **Two years' Results from the Cooperative Pasture at Coswig, in Anhalt (Germany).** — BUTZ *Landwirtschaftlich Umschau*, Year 6, No. 8, pp. 171-172. Magdeburg, February 20, 1914.

In the spring of 1911, the Coswig Cooperative Pasture Association was founded, and rented 28.64 acres of meadow land at 52*s* 4*d* per acre to use as a grazing ground for young stock. The pasture was divided into three almost equal enclosures separated by wire fences and provided with a shed and dinking trough. The expenses of laying out the pasture were as follows:

	£	*s*	*d*
1. Stamp duties for the contract	1	7	0
2. Statutes, advertisements, notification,	1	5	8
3. Loss on lease of pasture in 1911	14	1	3
4. Chemical fertilizers	22	14	5
5. Fencing materials.	63	2	1
6. Shed	38	5	3
7. Drinking trough	6	4	6
8. Wages of labourers.	23	2	5
9. Other wages.	11	3	1
Total expenses	£ 181	5	8

The pasture was opened in May 1912 and 12 foals and 37 heifers were turned in; in 1913, 19 foals and 20 heifers were put out to grass. If a foal's grazing day is reckoned as equal to 1 ¼ of a heifers' grazing day the pasture provided 4752 heifer-grazing-days in 1912 and 6478 in 1913, and in addition, in the first year a hay crop worth £12. 18*s*.

The outlay during the two years was as follows:

	1912			1913		
	£	*s*	*d*	£	*s*	*d*
1. Lease	74	19	5	74	19	5
2. Manures	17	10	7	6	8	9
3. Amortisation of capital (10 % on £ 181 5 *s*)	18	2	6	18	2	6
4. Interest (4 %)	7	5	0	6	10	6
5. Wages of stockman	6	16	0	9	11	4
6. Labourer's wages	—	—	—	3	3	9
1. Sundries	1	12	10	4	11	9
Total expenditure	£ 126	6	4	£ 123	8	0
Less hay sold	12	18	0	—	—	—
	£ 113	8	4	£ 123	8	0
The grazing-day therefore cost	5·73 *d*			4·57 *d*		

378 - **The Cost of Milk Production in the Counties of Kent and Surrey.** — GARRAD, G. H. and MACKINTOSH, J. in *South-Eastern Agricultural College, Wye, Second Report on the Cost of Food in the Production of Milk in the Counties of Kent and Surrey*, 1912, pp. 1-28. London, 1913.

An enquiry into the cost of milk production which was instituted in 1912 by the South-Eastern Agricultural College, Wye, extended over 20 farms in the counties of Kent and Surrey and a total of about 730 cows. In calculating the cost of the milk production, only the value of the food fed to the animals was considered, *i. e.* no allowance was made for attendance, etc. The necessary data for the calculations — the cost of the food and the milk yields — were collected by an inspector who visited the farms once a month for this purpose. The bought food was reckoned at market price, and homegrown produce at the cost of production, while the grazing value was calculated according to the rent of the various meadows.

The year was divided into three periods: winter (January-March), summer (April-October) and autumn (November and December): the average milk yield of each period was taken, and the cost of the daily food per cow and per gallon of milk was estimated.

The results are tabulated, and the writer discusses the differences observed from one farm to another. A summary of the results is given in the following table:

Period	Average daily milk yield per cow. gall.	Average cost of food per cow. per day	Cost of food per gallon of milk
Winter (January to March)	2.11	14.68 *d.*	6.96 *d.*
Summer (April to October)	2.24	5.70 *d.*	2.54 *d.*
Autumn (November and December)	2.05	11.90 *d.*	5.80 *d.*
Annual average	2.17	9.37 *d.*	4.32 *d.*

379 - **The Depopulation of the Country.** — LAUR, E. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part. 1, pp. 1-22 and Part 2, pp. 53-63. Stuttgart, January 1 and 15, 1914.

The writer makes use of the official census returns of about 20 different States for a general review of the changes in the rural population of these countries during the period from 1880 to about 1900. He compares the increase of population of towns (communities with from 2000 to 5000 inhabitants) with the increase or decrease of the rural population, and calculates the change in the percentage of both in the total population. If the numbers of inhabitants of the first census (which was taken in most States in 1880) be added together and compared with the sum of the second census (which, with one exception, refers to the year 1900 or a later year) the following figures are obtained:

		In 1880	In 1900 and later	Increase
Total population		273 550 133	351 831 079	78 280 946
Town communities	Population	108 694 959	173 469 479	64 774 520
	Percentage	39.73	49.30	59.59
Rural communities	Population	164 855 174	178 361 600	13 506 426
	Percentage	60.27	50.70	8.19

The populations of town and country have both of them increased, but the towns show an increase of 59.59 per cent. and the country of only 8.19 per cent. The decrease of the percentage of rural population in the whole population

TABLE I.

	Increase or decrease of			Percentage to total population			
				Town population		Rural population	
	rural population	town population	total population	about 1880	about 1900	about 1880	about 1900
Servia	+ 1.98	+ 4.22	+ 2.236	11.4	15.0	88.6	85.0
Greece	+ 1.69	+ 3.36	+ 2.025	20.2	25.0	79.8	75.0
United States	+ 1.415	+ 5.98	+ 2.59	25.8	37.3	74.2	62.7
Rumania	+ 1.3075	+ 2.57	+ 1.495	14.8	18.8	85.2	81.2
Hungary	+ 0.955	+ 2.045	+ 1.08	14.6	16.7	85.4	83.3
Portugal	+ 0.586	+ 1.564	+ 0.859	29.1	32.8	70.9	67.2
Chile	+ 0.54	+ 3.13	+ 1.425	34.2	43.3	65.8	56.7
Denmark	+ 0.52	+ 3.26	+ 1.29	28.0	40.2	72.0	59.8
Switzerland	+ 0.445	+ 2.90	+ 0.855	16.6	22.4	83.4	77.6
Canada	+ 0.405	+ 4.33	+ 1.21	20.5	30.9	79.5	69.1
Belgium	+ 0.38	+ 2.31	+ 1.207	43.1	53.2	56.9	46.8
Norway	+ 0.376	+ 2.35	+ 0.80	21.5	29.4	78.5	70,6
Sweden	+ 0.236	+ 3.22	+ 0.686	15.1	24.4	84.9	75.6
Austria	+ 0.18	+ 2.62	+ 0.905	29.6	38.2	70.4	61.8
Germany	— 0.104	+ 3.44	+ 1.36	41.4	57.4	58.6	42.6
England	— 0.17	+ 1.99	+ 1.293	67.9	78.1	32.1	21.9
Scotland	— 0.27	+ 1.76	+ 0.985	62.0	69.8	38.0	30.2
France	— 0.304	+ 1.05	+ 0.21	34.8	42.1	65.2	57.9
Italy	— 0.425	+ 1.02	+ 0.79	84.2	87.5	15.8	12.5
Ireland	— 1.09	+ 0.56	— 0.69	24.0	31.0	76.0	69.0

does not always signify that the population of the country has absolutely diminished. In reality in many States, especially in the so-called agricultural States, it has increased, but nowhere in the same measure as the town population. Only in some of the old civilized countries can a depopulation of the country be spoken of, as only they show an absolute decrease of rural population. In the Table I the various States are arranged according to the yearly increase or decrease of the rural population in percentages of the population of the year 1880. For comparison, the increase and decrease of the town population and of the total population, as well as the variations of the percentage of town and country population, are given also.

All the States show an increase of town population, which in most cases is in excess of the natural increase of the population. In all the States the percentage of the rural population in the whole population has diminished.

The writer then examines, in those States for which data are available, the changes in the agricultural population, in the working agricultural population, in the numbers of independent farmers and in those of farm employees. The results of this investigation are given in Table II.

TABLE II.

State	Percentage of yearly increase or decrease			
	of total agricultural population	of working agricultural population	of independent farmers	of agricultural employees
Bulgaria	+ 1.60	—	— 1.30	+ 4.23
Austria	+ 0.52	— 0.31	— 0.43	— 2.50
Denmark	+ 0.44	—	+ 2.74	— 0.69
Hungary	+ 0.39	+ 1.65	— 0.25	+ 0.62
Belgium	+ 0.04	— 0.68	+ 0.23	— 1.22
Switzerland	— 0.30	— 0.66	+ 0.05	— 0.73
Norway	— 0.33	— 0.71	—	—
Germany	— 0.38	+ 0.75	+ 0.33	— 0.64
France	— 0.46	+ 0.41	+ 0.42	— 0.63
Great Britain and Ireland	—	— 0.65	— 0.45	— 0.81
United States	—	+ 2.97	+ 0.74	—

With the exception of Austria, the agricultural populations have everywhere increased less rapidly or have decreased more than the total agricultural population. The agricultural population evidently loses more members by emigration to the towns and by change of occupation than the other callings in the country. In most of the old civilized countries there is an absolute decrease of the agricultural population, and only in the total agricultural population, and only in the agricultural States is there a nota-

ble increase of the numbers of persons engaged in agriculture. Nevertheless, the number of independent farmers has on the whole increased more or diminished less than the total agricultural population. The emigration of the agricultural classes has thus been the cause of a diminution of the existing labour in individual farms, rather than of a decrease in the number of independent farmers.

In concluding the writer treats of the causes of the emigration of the nhabitants of the country towards the towns, and of the means of retaining a numerous agricultural population. He considers the best means to be the prevalence of peasant farms and consequently maintainance, increase and improvement of the peasant classes; only the gradual conversion of the land into peasant farms will permanently solve the problem of the scarcity of agricultural labour.

AGRICULTURAL INDUSTRIES.

AIRYING. 380 - **Titration of Milk with Alcohol at Different Degrees of Concentration.** — LOHNIS F. in *Molkerei-Zeitung*. Year 28, No. 9 pp. 158-155. Hildesheim, January 30, 1914.

The alcohol test, as it is generally practised at present, that is to say by mixing equal volumes of milk and 68 or 70 per cent alcohol (by volume), is undoubtedly valuable for recognizing milk of abnormal quality, or such as, owing to its high content of bacteria, is barely utilizable. On the other hand the normal milk of commerce does not always coagulate with this test, even when its bacterial content is very high. Attempts have therefore been made to render the method more exact, and among other suggestions that of doubling the quantity of alcohol has been made.

Recent experiments conducted by the writer with 90 per cent alcohol at once gave highly encouraging results, whilst tests with 70 per cent alcohol at first failed completely. With milk rich in bacteria the writer had, it is true, satisfactory results even with 70 per cent alcohol. Eighty per cent alcohol gave, in general, still better results. Two cc. of milk at 15 to 20° C. (59 to 68° F.) were always taken for the titration tests with the various alcohols. The number of cc. used is called by the writer the "alcohol number" (Alkoholzahl) of the titrated milk. The number in brackets (90, 80, 70, etc.) indicates the concentration of the alcohol used in percentages by volume (Tralles degrees).

The operation of titrating presents no difficulty. The final point is best found by pouring the 2 cc. of milk into a small beaker which is kept somewhat slanting and shaking it gently over a black background. If the alcohol is allowed to fall carefully drop by drop into the milk the beginning of coagulation is recognized without difficulty, especialy where the milk only forms a shallow layer at the bottom. Duplicate experiments usually agree within 0.1 cc.; however, even differences of 0.2 or 0.3 would not generally be of any great importance. In the first titration experiments made by the writer 0.05 cc. was the greatest difference obtained in duplicate tests.

Quite fresh milk of many cows shows consistently high alcohol numbers over a lenth of time. For other cows, on the contrary, these numbers are consistently low. It is not rare, however, for the alcohol number to vary from day to day. This seems to depend, partly at least, upon the weather, and to increase and diminish with the temperature of the air. In winter the alcohol numbers have always been found surprisingly low. A mixture of milk from several cows gives more stable alcohol numbers than that from only one cow. The first milk obtained in milking usually gives alcohol numbers (90) higher by 0.5 to 1 cc. than that obtained towards the end. Nevertheless, in 25 per cent. of the cases the reverse was observed. The handling of the milk (scales, filter, cooler, etc.) most frequently has the effect of slightly lowering the alcohol number. The alcohol numbers of milk that had been kept some time increased or diminished according to the prevalence of the acid or curdling bacteria or of those which decompose protein.

Out of 73 mixtures of milk in which the writer determined the alcohol number, only four yielded divergent results. From the other results the following generalisation could be made:

Low	bacterial content:	Upwards of 4 cc.	of alcohol	(80)
Average	» »	2 to 4 cc.	»	»
High	» »	less than 2 cc.	»	»
Very high	» »	» » 2 cc.	»	(70)

If these numbers be compared with the values determined by the methyl blue test (according to the method recommenced by Orla Jensen and Chr. Barthel), it will be seen that there is no noticeable difference. The writer prefers the alcohol test because it allows the low bacterial content to be recognised (less than 100 000 per cc.) and the keeping qualities of the milk to be determined.

Where the milk tested was examined on the second day, the following results were obtained:

	Alcohol number (80) 1st day	2st day
2 900 to 41 350 bacterias per cc . .	4.3 to 7.3	4.8 to 6.1
200 000 to 4 000 000 » » » . .	2.2 » 5.8	1.6 » 3.1
Above 4 000 000 » » » . .	1.0 » 1.8	less than 1.

381 — **The Bactericidal Properties of Milk at Low Temperatures.** — De Rossi, Gino in *Rivista Scientifica del Latte*, Year 3, Part 6, pp. 90-91. Reggio-Emilia, December 1913.

Experiments were made with the object of ascertaining the behaviour of the bacteria in milk when the latter was placed in an ice-cellar immediately it was drawn, so that it was cooled nearly to freezing point. It was found that the few germs originally contained in the milk diminished so rapidly through the action of the low temperature that in a few days the milk was almost sterile. When the milk before cooling contained many bacteria, their numbers were considerably reduced by the cold. They began to diminish

within the first few hours, and continued to do so, reaching a minimum generaly by the sixth or seventh day, after which a new increase frequently set in. This fact can only be explained by the supposition that certain bacteria are not injured by the cold and that they can multiply at very low temperatures.

In another series of experiments, the writer investigated the behaviour of certain bacteria expressly added to the milk, especially germs of infectious d seases which are believed to the spread by milk. It was found that by the action of cold, cholera and diphtheria bacilli i troduced into the milk in large quantities were completely destroyed in an average time of 24 hours; but it required three or four days for typhus and tuberculosis bacilli to be destroyed or even much weakened

It thus appears that milk at low temperatures not only impedes the multiplication of bacteria, but diminishes their numbers, especially in the case of germs injurious to health. But a long storage of milk at freezing-point is not to be recommended, as the destruction of disease germs is accompanied by the development of a number of other bacteria, which though intrinsically harmless make the milk unfit for food.

382 **The Question of the Formation of Fat from Protein during the Ripening of Cheese.** — KONDO, KURO in *Biochemische Zeitschrift*, Vol. 59, Nos. 1 and 2, pp. 113 165. Berlin, January 22, 1914.

The writer prepared Cheddar cheese exactly according to the recipe, and estimated its fat content in the fresh condition, as well as during and after ripening, in order to ascertain whether fat was built up from protein during the maturing process. To this end, he divided each fresh cheese into four equal portions. He at once determined the fat content of one piece, and put the others aside to ripen, one in the air, one in an atmosphere of carbonic acid, and the last in an atmosphere of hydrogen. In addition, some of the cheeses were covered with paraffin and placed in the open air to ripen. From time to time the writer took a sample from each cheese and tested its fat content by the Kumagawa-Suto soap method (1). At the end of the experiment some fat determinations were also carried out by the ether extraction method for comparison.

The writer draws the following conclusions from the results of his experiments :

1. When cheese ripens in the air, there is always a decrease in its fat content. The decrease is not equal in similarly made cheeses; it usually begins ten days after storing, and increases with time. The amount of the diminution of the fat does not appear to depend solely upon the time of keeping, but very probably is also due to the physical pecularities of the cheese and to the temperature of the store-room.

2. The decrease in the fat content observed in cheese ripened in the air is caused by the presence of a mould which grows upon the surface of the

(1) A description of this method is to be found in Abderhalden's « Hendbuch der, biochemischen Arbeits-methoden » Vol. 5, pp. 477-488, publised by Messrs. I Springer Berlin.

cheese; the fat consuming propensity of this fungus was first established by Kumagawa and Ohta. The growth of the fungus usually begins after ten days of storing and increases so much with time, that the whole surface of the cheese is eventually covered with whitish fungus hyphae. The decrease in the fat content entirely corresponds to the growth of the fungus.

3. In the case of paraffined cheeses exposed to the air the decreases of the fat content is almost as great as in unparaffined ones. This proves that the oxygen of the air finds its way through the thin layer of wax and reaches the surface of the cheeses, thus permitting the germination of the fungus spores. If the cheeses are, however, dipped repeatedly in the paraffin bath from the beginning of the experiment, the fungus makes very little growth during the storage, and the decrease in fat is much less. The writer did not, however succeed in entirely checking the growth of the fungus by treating the cheese with paraffin.

4. The ripening of the cheese and the diminution in its fat content are two entirely separate processes; therefore the cheese need not necessarily always become poorer in fat through ripening. This is proved by the fact that there is no loss of fat when the cheese is ripened in the absence of atmospheric oxygen, under which condition it ripens as satisfactorily as in the air. Further, it was found that the non precipitating nitrogen always increased with the time of keeping and at the cost of the precipitating nitrogen; this occurred to the same extent whether the cheeses were kept in air, or in atmospheres of carbonic acid or hydrogen.

5. Aerobic bacteria are thus indispensable to the ripening of cheese, although it has not yet been ascertained whether this process depends upon anaerobic microorganisms, or whether it is not solely due to the presence in the cheese of pre-existing ferments. The writer inclines to the latter view.

6. The experiments on the lipoid content of the cheese which were carried out with the alcohol-ether extract method on the one hand, and with the soap method on the other, showed that the amount obtained by the former was throughout from 2 to 3 per cent. larger in the case of ripe cheese than in the fresh product, while with the latter method, the corresponding values were decreased from 2 to 3 per cent. The increase in the ether-extract in the cheese-ripening was, however, far less than the writer had expected.

7. It can thus be stated that under no circumstances does an increase of the fat content take place during te ripening of cheese, and consequently there can be no formation of fat from protein. The amount of fat in cheese ripened in the air continually decreases, owing to the growth of mould, of while it remains unchanged if the ripening process takes place in the absence of oxygen.

383 – **The Baking Qualities of Flour as influenced by Certain Chemical Substances, Milling By-products and Germination of the Wheat.** — WILLARD, J. T. and SWANSON, C. O. in *Kansas State College of Agriculture, Bulletin* No. 190, pp. 237-285 + plates I-IX. Manhattan, Kansas, October 1913. BREAD MAKING INDUSTRY.

The dependence of the physical properties of gluten on the presence of certain substances in small amounts suggested the following experiments

TABLE I.

Total time in minutes for rising as affected by different substances.

Substance	Minimum quantity in grams	Number of times minimum quantity					
		0	1	2	4	8	16
Peptones	0.4	180	172	166	158	153	149
Glycocoll. CH_2 (NH_2) COOH	0.1	172	164	160	166	165	162
Leucin $(CH_3)_2CH$ CH_2 $CH(NH_2)$ COOH	0.025	170	166	157	167	162	160
Aspartic acid COCH. CH_2. $CH(NH_2)$ COOH	0.1	160	151	142	125	130	135
Asparagin $CONH_2$ CH_2 $CH(NH_2)$ COOH + H_2O	0.1	176	161	149	149	144	142
Ammonium acetate CH_3. COON H_4	0.1	174	161	150	144	136	138
Ammonium tartrate NH_4 OOC. CHOH. CHOH. $COONH_4$	0.1	169	159	149	143	150	147
Ammonium chloride NH_4 Cl	0.025	157	155	155	148	142	138
Ammonium phosphate $(NH_4)_2$ HPO_4	0.1	162	159	152	150	156	159
Sodium phosphate Na_2 HPO_4 + $12H_2O$	0.4	170	166	155	154	161	170
Sodium bicarbonate $NaHCo_3$	0.1	176	175	170	186	184	180
Sodium formate H. COONa + H_2O	0.1	157	151	157	165	148	174
Potassium nitrate KNO_3	0.1	161	154	156	152	162	159
Bran extract, cold extraction	2.5 (¹)	166	156	148	145	128	131
Bran extract, cold extraction filtered	2.5 (¹)	161	152	145	143	135	137
Bran extract, hot extraction	2.5 (¹)	167	164	147	144	156	164
Wheat scourings, extract I	2.5 (¹)	135	127	118	119	118	113
Wheat scourings, extract II	2.5 (¹)	176	171	161	157	158	163
Flour from germinated wheat	25.0	162	140	118	113	133	143
Flour from germinated wheat	9.0	165	160	152	148	144	113
Cold bran extract from germinated wheat	2.5 (¹)	170	163	156	148	159	173
Boiled bran extract from germinated wheat	2.5 (¹)	127	128	135	131	208	192
Cold extract from shorts of germinated wheat	2.5 (¹)	153	133	125	121	115	163

(¹) Weights of material extracted.

on the effect of different quantities of the products of protein metabolism, inorganic salts, and extract of bran and shorts, on the baking qualities of flour. It is probable that hydrolysis of the proteins takes place during the growth of yeast in the flour and that the products thus liberated play an important part in the growth of the yeast and affect the physical properties of the gluten.

The yeast used in these experiments was obtained fresh from a local baker and stored in a dry refrigerator. It was thoroughly mixed and weighed out into glass-stoppered bottles in 10 gm. portions. Unbleached flour was heated to a temperature of 35° C. and used in 300 gram portions. The same amount of water was used in each test, *viz.* 165 cc., and the required quantity

TABLE II.

Rise in the oven during baking as affected by different substances.

Substance added	Minimum quantity grams	Number of times minimum quantity					
		0	1	2	4	8	16
Peptones	0.4	4.4	4.8	4.6	3.9	3.9	4.2
Glycocoll	0.1	4.3	3.9	2.5	3.1	3.5	1.8
Leucin	0.025	4.5	4.5	4.0	3.5	5.1	4.5
Aspartic acid	0.1	5.5	5.3	4.9	4.9	5.5	5.5
Asparagin	0.1	5.1	5.2	5.1	4.8	3.8	4.6
Ammonium acetate	0.1	4.4	5.2	5.4	5.5	5.5	5.3
Ammonium tartrate	0.1	4.7	5.0	4.8	5.2	5.6	4.4
Ammonium chloride	0.025	3.3	4.2	3.8	5.3	6.1	6.1
Ammonium phosphate	0.1	5.0	5.4	5.5	5.4	5.4	5.4
Sodium phosphate	0.4	4.4	4.5	4.7	4.2	4.5	4.6
Sodium bicarbonate	0.1	4.0	4.5	4.0	2.6	2.5	2.0
Sodium formate	0.1	5.5	5.5	5.3	5.1	5.5	5.5
Potassium nitrate	0.1	5.0	4.8	4.1	4.5	5.1	5.1
Bran extract, cold extraction	2.5 (1)	4.9	4.9	4.7	5.3	5.4	5.6
Bran extract, cold extraction filtered	2.5 (1)	5.0	5.2	5.4	5.4	5.6	5.7
Bran extract, hot extraction	2.5 (1)	4.2	4.5	4.8	5.4	5.6	5.9
Wheat scourings, extract I	2.5 (1)	5.4	5.7	5.4	5.1	5.1	5.1
Wheat scourings, extract II	2.5 (1)	3.8	4.0	3.1	3.9	3.5	2.9
Flour from germinated wheat	25.0	4.9	5.4	5.6	4.0	4.2	1.1
Flour from germinated wheat	9.0	4.3	4.5	4.7	4.5	3.7	2.7
Cold bran extract from germinated wheat	2.5 (1)	4.3	3.4	4.0	5.0	4.3	4.5
Boiled bran extract from germinated wheat	2.5 (1)	3.6	5.6	5.1	5.5	5.4	4.8
Cold extract from the shorts of germinated wheat	2.5 (1)	5.2	5.7	5.6	5.6	5.9	5.8

(1) Weights of material extracted.

of the substance added with 15 grams of sugar and dissolved in a beaker at 35° C. The yeast was mixed with this solution and allowed to ferment for 30 minutes at 35° C. before mixing with the flour. The dough was made by placing 200 grams of the warmed flour and the yeast liquor in a Kœlner kneader and working it at full speed for 30 minutes, when the remainder of the flour was added and worked into the dough with a spatula for 5 minutes. It was then tested by placing it in a cylinder 30 cm. high and of such a diameter that 1 cm. in height corresponds to 100 cc. All the doughs had a volume of about 550 cc. and were allowed to rise to a volume of 1650. The time was noted and the dough worked lightly in the hands and allowed to rise again as far as possible. It was worked in the hands again and placed in

TABLE III.

Volume of loaf as affected by different substances, in cubic centimetres.

Substances added	Minimum quantity added	Number of times minimum quantity					
		0	1	2	4	8	16
Peptones	0.4	1380	1390	1370	1280	1300	1320
Glycocoll	0.1	1380	1330	1270	1240	1180	1180
Leucin	0.025	1380	1340	1280	1270	1360	1330
Aspartic acid	0.1	1460	1470	1460	1420	1500	1530
Asparagin	0.1	1440	1410	1380	1380	1300	1370
Ammonium acetate	0.1	1440	1490	1490	1500	1520	1500
Ammonium tartrate	0.1	1460	1470	1450	1520	1550	1400
Ammonium chloride	0.025	1300	1420	1260	1520	1600	1610
Ammonium phosphate	0.1	1470	1470	1470	1470	1440	1430
Sodium phosphate	0.4	1430	1450	1460	1400	1410	1420
Sodium bicarbonate	0.1	1330	1370	1350	1210	1170	1170
Sodium formate	0.1	1550	1530	1500	1470	1550	1500
Potassium nitrate	0.1	1500	1480	1440	1500	1520	1520
Bran extract, cold extraction	2.5 (1)	1480	1490	1410	1510	1520	1520
Bran extract, cold extraction filtered	2.5 (1)	1470	1500	1520	1550	1550	1550
Bran extract, hot extraction	2.5 (1)	1400	1420	1440	1520	1550	1560
Wheat scourings, extract I	2.5 (1)	1450	1480	1500	1520	1540	1490
Wheat scourings, extract II	2.5 (1)	1360	1460	1280	1360	1260	1190
Flour from germinated wheat	25.0	—	—	—	—	—	—
Flour from germinated wheat	9.0	1400	—	—	—	—	—
Cold bran extract from germinated wheat	2.5 (1)	1350	1290	1310	1360	1320	1350
Boiled bran extract from germinated wheat	2.5 (1)	1360	1460	1400	1500	1460	1420
Cold extract from the shorts of germinated wheat	2.5 (1)	1460	1530	1520	1520	1530	1500

(1) Weights of material extracted.

weighed baking-cans so constructed that, when placed in the oven, the dough presses against a circular disc attached to a vertical shaft regulated so as to ensure a uniform rise in all the samples before baking. The loaves were ther baked 35 minutes at 240° C. and the rise during this time was measured on the shaft. After cooling 30 minutes they were weighed and the volume determined by displacement of flax-seed

The results are tabutated in tables I, II and III. They show that:

1) Peptones and amino acids have an adverse effect on the physical qualities of the gluten. The dough was sticky and the texture of the loaf

much inferior to that of the control. Asparagin appears to stimulate the activity of the yeast, thus shortening the time of rising.

2) Inorganic salts in general improve the quality of the dough and bread, this effect being most marked in the case of ammonium chloride. This salt was very effective in such small quantities as $^1/_{300}$ to $^1/_{75}$ ounce per loaf, corresponding to the medicinal dose of this salt. Sodium bicarbonate has an injurious effect probably owing to its alkaline nature.

3) Extract of bran appears to stimulate the activity of the yeast, thus shortening the period of rising and increasing the rise during baking and the loaf volume. It had, however, an injurious effect on the texture of the loaf. The hot extract had less effect in shortening the time of rising, thus suggesting that the stimulating effects of the cold extract on the yeast are due to enzymes.

4) Ordinary bran mixed with flour gave loaves of poorer texture than those made with extracted bran and extract of bran used separately.

5) Extract of scourings (*i. e.* wheat dust and offal) shortened the period of fermentation and produced a sticky dough, thus resulting in a loaf of inferior texture. These effects were more pronounced with the products of germinated wheat. The dough was exceedingly difficult to handle and the loaf from the flour of germinated wheat fell to pieces.

Conclusions :

1. — The results obtained with ammonium chloride suggest further experiments to study its effect on the growth of yeast and to determine the quantity remaining in the bread.

2. — The constituents of the bran extract affecting the growth of yeast and the qualities of the gluten may have important chemical effects, which may account for the beneficial effects of Graham bread. Further experiments are suggested to determine the nature of these constituents and their effects on nutrition.

3. — It would appear that Graham bread might be improved by soaking the bran separately before mixing with the flour.

4. — The effect of extract of scourings appears to be due to the same cause as the effect of flour from germinated wheat, *i. e.* the amino-decomposition products of the wheat proteins.

5. — The methods of handling and storing grain and flour would appear to be capable of affecting its baking qualities to a considerable extent.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

384 - **The Recommendations of the International Phytopathological Conference** (Rome, February 24-March 4, 1914).

On February 24, 1914, a conference was held in Rome at the International Institute of Agriculture for the purpose of securing international cooperation in the control of plant diseases. The Conference, which was held under the auspices of the Institute, was summoned by the French Government in conjunction with the Italian Government; the following States took part in it and sent their delegates:

ALGERIA:

LOUIS DOP, Vice-President of the International Institute.

R. MAIRE, Algiers.

AUSTRIA:

KARL PORTELE, Professor and Aulic Councillor, Ministry of Agriculture.

Chev. V. DE POZZI, Government Councillor, Delegate to the Permanent Committee of the International Institute.

BELGIUM:

T. VERNIEUWE, Director of the Horticultural Office, Ministry of Agriculture.

O. BOLLE, Delegate to the Permanent Committee of the International Institute.

P. MARCHAL, Botanist at the State Agricultural Institute, Gembloux.

CANADA:

H. G. GUSSOW, Dominion Botanist.

CHILE:

S. ALDUNATE, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

CHINA:

SIU-KIU, Delegate to the Permanent Committee of the International Institute.

COSTA RICA :

R. MONTEALEGRE, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

DENMARK :

A. DE OLDENBURG, Chargé d'affaires, Delegate to the Permanent Committee of the International Institute.

Dr. KÖLPIN RAVN, Royal Danish Veterinary and Agricultural College.

DOMINICA :

Count PASINI-FRASSONI.

FRANCE :

J. DEVELLE, Senator, Ex-Minister of Foreign Affairs and of Agriculture.

R. DE BILLY, Minister Plenipotentiary, Councillor at the French Embassy.

LOUIS-DOP, Vice-President of the International Institute.

L. MANGIN, Membre de l'Institut, Natural History Museum, Paris.

E. L. BOUVIER, Membre de l'Institut, Natural History Museum, Paris.

P. MARCHAL, Membre de l'Institut, Director of the Entomological Station, Paris.

E. SCHRIBAUX, Director of the Seed Testing Station, Paris.

E. FOEX, Sub-Director of the Station for Plant Pathology, Paris.

GERMANY :

Dr. T. MUELLER, Privy Councillor, Delegate to the Permanent Committee of the International Institute.

Dr. JUNG, Privy Councillor, Member of the Council of the Imperial Biological Institute, Dahlem.

Dr. BEHRENS, Privy Councillor, Director of the Imperial Biological Institute, Dahlem.

GREAT BRITAIN :

Lt.-Col. Sir DAVID PRAIN, Director of the Royal Botanic Gardens, Kew.

Sir JAMES WILSON, K. C. S. I., Delegate to the Permanent Committee of the International Institute.

A. G. L. ROGERS, Director of the Horticultural Section, Board of Agriculture.

GREECE :

Co. A. ISAAKIDES.

GUATEMALA :

T. MONTEFIORE, Consul General, Delegate to the Permanent Committee of the International Institute.

HUNGARY :

E. DE MIKLÓS, Secretary of State, Member of House of Magnates, Delegate to the Permanent Committee of the International Institute.

Dr. G. DE ISTVÁNFFY, Director of the Viticultural Institute, Budapest.

BRITISH INDIA :

H. MAXWELL LEFROY, Imperial College of Science and Technology, London.

IRELAND :

G. H. PETHYBRIDGE, Economic Botanist, Department of Agriculture and Technical Instruction, Ireland.

ITALY :

Marquis R. CAPPELLI, Vice-President of the Chamber of Deputies, President of the International Institute.

Prof. BATTISTA GRASSI, Senator, Membro dell'Academia dei Lincei.

ORESTE SAVINA, Consul General, Ministry of Foreign Affairs.

Prof. MICHELE CARLUCCI, Chief Inspector of viticulture and plant diseases.

Prof. ANTONIO BERLESE, Director of the Station for Agricultural Entomology, Florence.

Prof. G. CUBONI, Director of the Station for Plant Pathology, Rome.

JAPAN :

M. N. ITO, Attaché at the Embassy, Delegate to the Permanent Committee of the International Institute.

LUXEMBURG :

T. VERNIEUWE, Director of the Horticultural Office, Ministry of Agriculture, Brussels.

O. BOLLE, Delegate to the Permanent Committee of the International Institute.

P. MARCHAL, Agricultural Institute, Gembloux.

MONACO :

Dr. PAUL REGNARD, Member of the Academy of Medicine, Director of the " Institut Agronomique " and of the Oceanographical Institute, Paris.

MAROCCO :

LOUIS-DOP, Vice-President of the International Institute.

NETHERLANDS :

Baron W. B. R. DE WELDEREN RENGERS, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

P. van HOEK, Director of Agriculture.

Prof. T. RITZEMA BOS, Director of the Phytopathological Institute, Wageningen.

OTTOMAN EMPIRE :

Dr. MEHMED DJEMIL BEY, Delegate to the Permanent Committee of the International Institute.

ROUMANIA :

C. PENNESCO, Councillor at the Legation, Delegate to the Permanent Committee of the International Institute.

V. BARANGA, Secretary of the Ministry of Agriculture and Estates.

G. ARION, Entomologist, Ministry of Agriculture and Estates.

RUSSIA :

His Excell. G. ZABIELLO, Consul General, Delegate to the Permanent Committee of the International Institute.

A. DE JACZEWSKI, Lord Chamberlain to H. M. the Emperor, Director of the Mycological and Phytopathological Bureau of the Scientific Committee of the Office for Agricultural Organisation and Agriculture.

SERVIA :

L. MICHAÏLOVITCH, Chargé d'Affaires.

SPAIN :

E. R. DE CELIS, Delegate to the Permanent Committee of the International Institute.

SWEDEN :

Baron C. N. D. DE BILDT, Minister Plenipotentiary, Delegate to the International Institute of Agriculture.

Prof. J. ERIKSSON, Chief of the Botanical Section, Central Institute for Agricultural Experiments, Stockholm.

SWITZERLAND :

J. B. PIODA, Minister Plenipotentiary, Delegate to the Permanent Committee of the International Institute.

Prof. MÜLLER-THURGAU, Director of the Federal Experimental Station for Arboriculture, Viticulture and Horticulture, Wadensweil.

Dr. FAES, Director of the Phytopathological Section of the Viticultural Experimental Station, Lausanne.

TUNIS :

LOUIS-DOP, Vice-President of the International Institute.

A series of meetings was held from February 24 to March 4, 1914, at which the delegates expressed the general desire of their respective Governments to abide by previous decisions of the General Assemblies of the International Institute of Agriculture, and to continue and further measures already agreed upon at previous agricultural congresses. The Conference, without in any way interfering with the measures adopted under existing international agreements, drew up the following draft Convention to be dated March 4, 1914, and to be submitted to the various Governments for approbation, and signed by plenipotentiaries nominated for the purpose if approved.

Art. 1. — The contracting States undertake to adopt the legislative and administrative measures necessary to ensure common and effective action against the introduction and spread of plant enemies.

These measures shall especially deal with : 1) the efficient supervision of nurseries, gardens, green-houses, and other establishments supplying the market with live plants (young plants, cuttings, scions, flower-bulbs and cut blossoms) ; 2) the reporting of the appearance of plant diseases and of injurious animals, and the specification of infected districts ; 3) the means of checking and preventing plant diseases ; 4) the regulation of the transport and the packing of plants and of the parts of plants mentioned above ; 5) the measures to be taken in case of infringement of regulations.

Art. 2. — There shall be created in each State adhering to the present

Convention an official Phytopathological Service for the purpose of carrying out these measures.

The official Phytopathological Service will include as a minimum: 1) the creation of one or more research stations for scientific and technical investigations; 2) the organisation of the efficient supervision of cultivation; 3) the inspection of consignments; 4) the issue of phytopathological certificates.

Art. 3 — The measures mentioned in paragraphs 2, 3 and 4 of art. 2 shall already have been carried out at the time of the ratification of the present convention, or of adherence to it. All the other measures in arts. 1 and 2 shall be carried out in each State within two years from the date of the ratification of the present Convention, or of adherence to it.

Art. 4. — The provisions of the present Convention shall not apply to vines, grain and seeds, edible tubers, bulbs, rhizomes and roots, fruits and vegetables, or to any crops grown on a large scale.

Art. 5 — With a view to the protection of the contracting States from the introduction and spread of plant enemies, these States undertake to allow the importation of live plants (young plants, cuttings, scions, flower-bulbs and cut flowers) only if they are accompanied by a phytopathological certificate issued by competent officials of the exporting country.

Art. 6. — The importation of the plants mentioned in the preceding article shall take place only through specified customs offices, of which a list will be drawn up by the importing country and sent to the exporting country.

Art. 7. — Each country reserves the right of inspecting all living plants, or parts of plants, imported.

In the event of the consigment being infected, contrary to the declaration on the certificate, the importing country shall at once inform the Government of the exporting country, which will take the measures provided for by its own regulations.

Products recognized as infected shall be returned to their original starting point at the expense of the defaulting party, or burnt should the consignee desire it; in the latter case, an official report shall be forwarded to the Government of the exporting country.

Art. 8. — The certificates shall conform to the model annexed to this Convention, and shall be drawn up in two languages: French, and the language of the exporting country.

Art. 9 — Live plants imported for scientific purposes are not subject to these restrictions; they may be admitted, even without certificate, on condition that they are directed to a scientific institution duly authorised by the Government of the importing country, and that the conditions under which they are sent afford every guarantee against the dispersion of the parasites. Contiguous States may make mutual arrangements to facilitate exchanges of plants in the frontier zones.

Art. 10. — The different contracting States are invited to send a list of the plant enemies against which they desire to protect themselves, to the

International Institute of Agriculture at Rome, at the time of the ratification of the present Convention or of their adherence to it. The list will be as short as possible and will be entered on their respective certificates. These lists will be drawn up according to the following principles:

A. Common enemies of plants, which have long since spread to nearly all countries, will be excluded from the lists; as well as parasites whose usual host-plants do not exist in the importing countries.

B. In specifying the plant enemies which are to appear on the lists, the choice will be limited to:

1. Those of an epidemic character.
2. Parasites which are destructive, or at least very harmful to crops.
3. Those which are easily propagated by live plants, or by living parts of plants.

Art. 11. — The creation of an official Service of Phytopathology shall be notified by each contracting State to the International Institute of Agriculture at Rome.

Art. 12. — From the date of the signature of the present Convention, the contracting States shall recognise the International Institute of Agriculture at Rome as the official international centre for all questions relating to plant enemies.

The Institute shall collect statistical data, together with information of an administrative, scientific, or practical nature dealing with all plant diseases and plant enemies. These data will be obtained from documents which shall be furnished to it as promptly as possible by the official Phytopathological departments, and by the Phytopathological Research Stations authorised and controlled by the Governments.

Art. 13. — The International Institute of Agriculture shall publish, at least once a month, the administrative, scientific and practical information transmitted to it.

Art. 14. — Every proposal made by a contracting State, for the modification or amplification of the present Convention, shall be communicated by that State to the Institute, and referred by it to a meeting of special delegates of the contracting parties, which shall be called together on the occasion of a General Assembly of the Institute.

The General Assembly will subsequently submit the proposals elaborated by these special delegates for approbation by the States adhering to the present Convention.

Art. 15. — In case of any disagreement between two, or more, of the contracting States as to the interpretation of the clauses of this Convention, or in cases of difficulties of a practical nature with regard to its application, the parties in question undertake to submit their differences to discussion by a special mixed Committee formed by members of their Phythopathological departments, with a view to the proposal of measures calculated to adjust the differences.

Art. 16. — The States bound by the present Convention shall not treat non-contracting Countries more favourably than contracting States.

Art. 17. — The present Convention shall be signed and ratified as soon as possible, and the ratifications shall be deposited with the Italian Government as soon as at least three of the contracting States are in a position to do so.

Each ratification shall be communicated by the Italian Government to the other contracting States, and also to the International Institute of Agriculture.

Art. 18. — States which have not signed the present engagement shall be allowed to adhere to it on request.

At the request of the States upon which they are dependent, Colonies shall be permitted to adhere on the same conditions as independent States.

Art. 19. — Adherence shall be notified through diplomatic channels to the Italian Government, and by it to the contracting Governments and also to the International Institute of Agriculture.

Art. 20. — The ratification, or adherence, shall be accompanied by a formal declaration to the effect that the State possesses at least the staff mentioned in paragraphs 2, 3 and 4 of art. 2.

The present Convention will come into force, for the three first States at least which shall have ratified it, after a lapse of three months from the date of ratification; for the other States, after a lapse of six months from the respective date of deposition with the Italian Government of their ratification, or adherence.

Art. 21. — Should it happen that one of the contracting States wished to withdraw from the present Convention either with regard to its whole territory, or only with regard to the whole or a portion of its Colonies, its wirthdrawal shall be notified to the Italian Government, which shall immediately send a copy of the notification to all the other States, informing them of the date on which it received the communication.

The withdrawal will apply only to the notifying State or to the Colonies mentioned in the notification, and this only after one year has elapsed from the time the notification was received by the Italian Government.

As a guarantee, the delegates attending the final meeting signed the formal record of these recommendations, which was dated Rome, 4th March, 1914. The original document is deposited at the Italian Ministry for Foreign Affairs. Certified copies will be sent to all the States represented at the Conference.

APPENDIX TO THE FINAL
ENACTMENT OF THE CONFERENCE.

International Phylloxera Convention of Berne
and International Phytopathological Convention of Rome

CERTIFICATE
FOR THE DESPATCH OF HORTICULTURAL PLANTS. *

NAME OF COUNTRY OF EXPORT

I. — Declaration of Consigner.

The under-signed (1) . . . .
hereby declares:

A. That the plants (2) . . . .
. . . .
contained in (3) . . . . . .packages, marked . . . . (4) . . . . . .
. . . .addressed to (5) . . . .
in (6) . . . . .have been produced on his establishment, or on other establishments subjected to inspection by the Phytopathological department.

B. That this consignment contains no vines.

C. That the plants are packed (7) . . . . . . .their ball of soil.

(8) . . . . . . the . . . .day of 191

Establishments inscribed on the list drawn up according to art. 9 § 6 of the Phylloxera Convention of Berne, under the No. . . . . (10)

Consigned by . . . . . . (9)

(1) Name, firm, profession and address. — (2) Kind and quantity of plants. — (3) Number of packages. — (4) Mark and number. — (5) Full address, name and profession of consignee. — (6) Name of country of destination. — (7) State whether the plants are packed *with* or *without* their ball of soil. — (8) Place from which sent. — (9) Signature of consigner. — (10) Give the number entered on general list.

* Each statement on the certificate must be accompanied by a translation in French.

II. — Certificate of the Administrative Authority *.

The administrative authority (1) certifies:

A. That the above consignment of plants comes from a holding that is at least 20 metres distant from any vine stock, or that is separated from such stock by an obstacle to roots which is considered to be sufficient by the competent authority.

B. That the holding itself contains no vines.

C. That no depôt for this plant exists on the holding.

D. That the holding has never been a centre of phylloxera infection.

E. That if the holding has contained phylloxerous vines at any time, these have been radically removed, and that suitable means of eradicating the disease and repeated inspections for three consecutive years, have ensured the complete destruction of the insect and of the roots.

Date . . . .

Seal of competent local authority	. . . . (signature)

(1) Burgomeister, mayor, or other competent local authority.

* This certificate should not be filled in where the holding figures on the list published in accordance with art. 9 § 6 of the International Phylloxera Convention of Berne.

III. — Certificate of Phytopathological Inspection.

The undersigned Inspector of the Phytopathological Department (1) . . . . certifies that the consignment referred to in the declaration of the consigner (2) . . . . .consists of the produce of crops grown at . . . .

The results of inspection have shown that the

(3) { home-grown produce / transported produce }

is in a satisfactory state of health and is free from the following parasites (4) . . . .

Date . . . .

Seal	(Signature)

(1) Christian name, surname, official position and address of the inspector. — (2) Christian name and surname of the consigner. — (3) Strike out, as required, the irrelevant words.. — (4) Add the list of plant parasites enumerated in the official list of the importing country which might be present in the consignment.

385 - **A Law Placing at the Disposal of the Minister of Agriculture of France from the Budget of 1913 the Sum of 750 000 frs. for the Control of Voles.** — *Journal Officiel de la République Française*, Year 46, No. 10, p. 314. Paris, January 11, 1914.

On January 7, 1914, the President of the Republic French promulgated the following law.

The sole article. — In addition to the sums allotted to the Minister of Agriculture from the Budget of 1913 by the finance law of July 30, 1913, and by special laws, an extraordinary credit of 750 000 fr. (nearly £ 30 000) is placed at his disposal; this sum will be entered under a special heading bearing the number 28 *bis* and entitled as follows: "Grants to Communes, Syndicates and Agricultural Associations for the Destruction of Voles. Cost of Organisation of Control Measures".

This sum will be provided by the general funds of the financial year 1913.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

386 - **The Importance to Vegetation of the Dissipator (Lattice-work) Chimney.** — WINKELMANN, H. in *Die Naturwissenschaften*, Year II, Part 10, pp. 225-229 + 2 plates. Berlin, March 6, 1911.

The writer describes a new method of preventing the bad effect upon vegetation which is exerted by the smoke gases from factories. This method consists in the adoption of the so-called lattice-work or dissipator chimney. The latter differs from an ordinary chimney in the fact that the smoke leaves the shaft already mixed with air and with a more or less strong rotatory motion, and not in a compact column; this permits of the more rapid division of the smoke and of its quicker diffusion in the atmosphere. No chemical change takes place, however, in the injurious gases which are given off.

BACTERIAL AND FUNGOID DISEASES.

387 - **Fungus Diseases of Wheat, Barley and Citrus Fruits in Egypt.** — ROLLAND, B. G. C. in *The Agricultural Journal of Egypt*, Vol. III, Part I, pp. 28-30, plate I. Cairo, 1913. BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

The smut diseases, known in Arabic as "el khamira", are of frequent occurrence throughout Egypt. Wheat is attacked chiefly by *Ustilago Tritici*, while barley is attacked by both *U. nuda* and *U. Hordei*.

The writer also describes a disease of citrus fruits, especially oranges, known as wither-tip and caused by *Colletotritichum gloeosporioides* Penz.

He gives an account of the means by which these fungi are controlled.

388 – **Experiments on the Control of *Pleospora trichostoma* on Barley.** — MÜLLER, H. C. and MOLZ, E. in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 17, pp. 205 and 206. Berlin, February 1914.

As the control of the " brown streak " of barley leaves (caused by *Pleospora trichostoma*=*Helminthosporium gramineum*) is generally combined with the control of the two smuts (*Ustilago Hordei* and *U. nuda*), the writers carried out experiments in this direction. They obtained the following results:

1) Winter barley was entirely freed from *Pleospora trichostoma* by 16 hours' treatment with Kühn's ½ per cent. copper sulphate. The germination of the seed in the field was, however, diminished from 95.2 to 80.2 per cent.

2) The hot-water treatment was harmful to both winter and summer barley. On the other hand, intermittent hot water treatment was efficacious in the control of *Pleospora trichostoma*; this was of greater practical importance from the fact that both the smuts were destroyed at the same time, although the fact that the smut attack was not severe makes it impossible to give a safe opinion as to the efficacy of the remedy in the latter case. The treatment consists in putting a sack three-quarters full of barley for 3 hours into water at 40° C. (104° F.) and then for 10 minutes into water at 48° C. (118.4° F.) After the grain has been somewhat cooled by being put for one minute into water at about 40° C., it is left in the sack for two hours in a heated room and subsequently again immersed for 10 minutes in water at 48° C. Then it is spread out and quickly dried by repeated shovelling. As this process has an injurious effect on germination, 10 per cent. more seed should be sown than usual.

3) A combination of the hot-water and copper sulphate treatments destroys *Pleospora trichostoma* on winter barley, but is liable to do much injury to the germinating property of the grain.

4) Formaldehyde, which has been largely and successfully used in the control of bunt of wheat, had little effect on *Pleospora trichostoma* on summer barley.

5) Hot-air treatment in a thermostat considerably increased the severity of the attack of *Pleospora trichostoma*.

The observations made for the purpose of ascertaining how for the attack depended upon the time at which the barley was sown, showed that the temperature during the germination and growth of the young barley plants greatly influences the occurrence of the disease. Other reasons, however, make it undesirable to try and control the parasite by means of later sowing.

389 – **Experiments on the Control of *Urocystis occulta* (Wallr.) Rabenh. on Rye.** — MÜLLER, H. C., and MOLZ, E. in *Deutsche Landwirtschaftliche Presse*, Year XLI, No. 13, p. 164 + 2 plates. Berlin. February 14, 1914.

The results of the pickling experiments carried out by the writer for the control of " stem-smut " of rye (*Urocystis occulta*) are given in the following table.

Number of plot	Treatment	Germination in artificial germinating bed after		Germination in the field	*Urocystis occulta*: No. per plot
		5 days %	10 days %	%	
1	Untreated	82.5	86.0	73.2	234
2	Copper sulphate ½ %, 16 hours	82.0	86.5	73.4	0
3	» » » » 16 hours + subsequent 6 % lime treatment	79.0	82.0	77.6	0
4	Copper sulphate 3 %, incrusted	79.0	84.0	78.8	0
5	Linseed oil soft soap 3 %, incrusted; then copper sulphate 3 %, incrusted	87.0	88.5	77.6	3
6	Copper sulphate 5 %, incrusted	69.0	84.5	64.6	0
7	Linseed oil soft soap 3 %. then copper sulphate 5 %, incrusted	76.1	87.5	72.6	0
8	Bordeaux mixture 2 %, incrustad	81.5	85.5	72.0	0
9	Linseed oil soft soap 3 %, then Bordeaux mixture 2 %, incrusted	86.5	89.5	75.0	7
10	Formaldehyde * ¼ %, 15 minutes	83.0	89.5	81.6	0
11	» » 30 »	79.5	87.0	72.0	0
12	Untreated	82.5	86.0	74.6	226
13	Formaldehyde ½ %, 15 minutes	84.5	87.0	62.2	3
14	» » 30 »	74.0	84.0	63.8	0
15	» ¾ % 15 »	64.0	79.0	46.6	1
16	» » 30 »	34.0	78.5	42.2	0
	Soaking in: water at — and hot water at				
17	30° C., 4 hours — 50° C., 10 minutes	51.0	85.5	67.0	2
18	» » — 52° C., 5 »	63.5	84.5	78.4	0
19	» 6 hours — » 10 »	63.5	87.0	70.2	0
20	20° C., 15 » — 50° C., 10 »	42.5	79.0	74.0	0
21	» » » — 52° C., 5 »	6.5	41.5	34.4	3
22	» » » — » 10 »	0.0	26.0	9.8	0
23	Jensen method	82.0	85.0	78.8	3
24	Untreated	85.0	87.0	78.8	154
25	Sublimate 0.1 %, incrusted	87.0	90.0	77.4	3

* Using 40 % commercial formaldehyde.

From these figures, it is clearly seen that *Urocystis occulta* is very easily controlled by the well-known dip poisons, copper sulphate and formaldehyde, and also by the hot water treatment.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

390 – ***Ranunculus sceleratus*** (1) **and *R. Guilelmi-Jordani* as Weeds in Egypt.** — ROLLAND, B. G. C. in *The Agricultural Journal of Egypt*, Vol. III, Part I, pp. 31-32, plates II-III. Cairo, 1913.

These two species of *Ranunculus* are considered noxious weeds in Egypt. *R. sceleratus* L. is a common plant by the sides of pools and wet ditches, and is particularly common on the fresh Nile mud on both sides of the river. It flowers from April to January. *R. Guilelmi-Jordani* Aschers also grows by the side of pools and wet ditches and flowers during the same period.

INSECT PESTS.

GENERALITIES.

391 – **Entomological Pests and Problems of Southern Nigeria.** — PEACOCK, A. D. in *Bulletin of Entomological Research*, Vol. IV, Part 3, pp. 191-220, plates XXIII-XXVIII. London, 1913.

The writer gives an account of the results of a journey made in Southern Nigeria with the object of studying the economic conditions of the colony in connection with the insect pests of cultivated plants.

INSECTS AFFECTING COTTON.

Cotton stainers. — Among the insects that injure cotton the most interesting is the red cotton-stainer bug (*Dysdercus superstitiosus* F.). This stainer is the worst pest of Southern Nigerian cotton, and does an immense amount of harm both to the seed and to the lint, by sucking the juices of the former and staining the latter with yellow excretory juices. The stained condition of the cotton in the native markets in the Western Province, and especially the cotton gathered late in the season, is striking.

The writer made some experiments to test the value of cotton seed and pressed cotton seed as bait for the purpose of enticing stainers, and then catching them directly with traps or shaking the plants over a funnel-shaped collecting net. The best system hitherto adopted by the Superintendent of Agriculture, Ibadan, consists in gathering the cotton as soon as it is ripe, sunning it well and constantly turning it over, which causes the stainers to crawl away, when they may be collected and killed, thus diminishing the chances of further staining, and lastly burning the old cotton stalks.

The black cotton-stainer (*Oxycarenus dudgeoni* Dist.) is probably distributed throughout the whole Colony; it also is very injurious to cotton, because like the preceding s ainer it sucks the juices of the seeds; it lays its eggs in clusters at the base of the boll, securely protected by the lint from sun and possible enemies. There seems to be a decided preference for

(1) See also No. 187, *B.* Feb. 1914. (*Ed.*).

certain species of *Hibiscus* as food plants, for some of these plants were found at Ibadan to be black with these pests.

The measures suggested to control the red cotton bug apply equally well here.

Boll-worms. — The larvae of *Diparopsis castanea* Hmp., *Earias biplaga* Wlk., and *Chlorida obsoleta* F. bore into the unopened ripening cotton and devour the seeds inside. The larvae leave one boll for another and frequently all the bolls on one plant are utterly spoilt. At the end of the 1911 season the condition of the plants was found to be serious.

The treatment may be outlined as follows: For imported cottons, a careful look-out should be kept for leaf-rollers and boll-worms during August and September. Immediately the presence of the insects is detected, the leaves, bracts, bolls and buds in the affected area should be most thoroughly sprayed, more or less frequently according to the condition of the crops as the season advances. At the end of the season all the old stalks with the diseased bolls should be burnt.

As for native cottons, before they can be treated as suggested above, two courses are open: 1) the obtaining by selection of a smaller native variety; 2) the topping and trimming of the plants and widening the distance between the drills.

Leaf-rolling caterpillars. — The larvae of *Sylepta derogata* F. and *Zebronia phenice* Cram. cut and roll the leaves of cotton into the shape of a tent; in these shelters they feed on the inner rolls of the leaf. As many as 12 caterpillars of *Sylepta derogata* may flourish in one shelter, while *Zebronia phenice* is usually solitary and is generally found where okra (*Hibiscus esculentus*) is grown. *S. derogata* is extensively parasitized by a species of Braconid and a Tachinid fly.

The *green fly* (*Aphis gossypii* Glov.) — Its numbers are kept well in check by natural enemies. Should the aphis show the least sign of increasing beyond natural control, spraying with a resin wash is recommended.

The following insects have also been observed as injurious to cotton plants: *Epilachna chrysomelina* F., *E. similis* Muls. var. *assimilis* Muls., *Lagria villosa* F., and *L. viridipennis* F., *Siderodactylus* sp., *Syagrus calcaratus* F., *Plagiodera circumcincta* Sahlb., *Nisostra uniforma* Jac., *Ootheca mutabilis* Sahlb., *Euproctis* sp. and *E. lyonia* Swinh., *Pulvinaria jacksoni* Newst., *Ripersia* sp.

Some of the above insects are parasitized by Hymenoptera and Diptera not yet determined.

The writer mentions a curious affection observed on the native Ishan and Meko cottons. The leaves become at first mottled with pale green or yellow spots, the undersides being densely and minutely pock-marked. Ultimately the leaves shrivel and curl. The young leaves at the tip of the shoot seem to be affected first, the older and larger leaves afterwards, till the whole plant presents a most forlorn appearance. The cause of the disease is probably physical, as no insect or mite was discovered. From the end of August to the end of October 1912 the trouble grew roughly from 8 per cent. to 25 per cent. The percentage was arrived at by ob-

serving the same plants to the number of 1000 in the Ishan, and 1800 in the Meko.

Cotton demands unceasing watchfulness and care from the time when it has two leaves, when attacks of grasshoppers, beetles and caterpillars may be detrimental to a good early strart; through the leaf growing period when leaf-rollers, caterpillars and aphis are at work; through the all-important period of bud - and boll-formation, when boll-worms are active; and up to the ripening and picking period, when stainers are mischievous. The measures recommended will not be of any use unless the pests are attacked with energy and general cooperation. The difficulties of making cotton worth extensive exploitation are many: these are the inertia of the native towards clean farming; the difficulty of obtaining a good variety of native cotton which would fetch better prices and make it worth while expending labour and money in combating pests; the difficulty of popularising even simple entomological methods; and greatest of all the fact that cacao and rubber are more valuable than cotton and that the country is the land *par excellence* of the oil palm.

Even if a better native variety is produced, cotton will probably never be more than a useful native catch-crop.

INSECTS AFFECTING CACAO.

Cacao is attacked by leaf-eating caterpillars, among which is *Diacrisia maculosa* Stoll., a species widely distributed throughout Africa; the caterpillars are voracious feeders, like those of *Prodenia litura* F. which devour the leaves. From a larva of this species an Ichneumonid, *Metopius discolor*, has been bred. Another species of *Diacrisia* and *Rhopalocampta forestosa* Cram. also feed on the leaves. The writer enumerates many other insects found on cacao, but little is known as to their economic signifiance.

The leaf-eating beetle, *Adoretus hirtellus* Castn., common in West Africa, feeds on the leaves of cacao, eating only the soft tissue. After describing some experiments made to control this pest, the writer advises clean farming and the segregation of cacao beds from maize, a combination of hand-collecting and spraying and maintaining unremitting watchfulness.

Another serious pest is the pod-borer, perhaps belonging to the genus *Myelois*, which is found in large numbers, up to 120, meshed in a ravel of silk among dry brown powder and riddled seeds, in cacao pods left hanging on the trees or lying on the ground. Judging from the thousands of old pods thus left neglected at Agege on the native farms, the damage done must be incalculable. The larva of a Cerambycid, common at Agege, does serious damage by boring in the trunk and branches; the adult is unknown.

Catantops vittipes Lauss. (Locustidae) eats the leaves. *Ceratitis punctata* Wied., a species of *Monanthia*, *Pseudococcus virgatus* var. *madagascariensis* Newst. and *P. citri* Risso (?) are also injurious.

The red tree-ants (*Oecophylla smaragdnia longinoda* Latr.) are not harmful to the cacao trees, but owing to their numbers and their irritating bite, they are a great nuisance to the native collector when at work.

Among the beneficial insects the writer mentions *Metopius discolor* Tosq., a *Sisyropa* which parasitizes the larvae of *Diacrisia maculosa* Stoll., and the following Carabidae which are probably useful in destroying harmful insects: *Oodes obesus* Murray, *Platynus planaticollis* Murray and *Chlaenius westermanni* Laf., and some others of doubtful significance.

Insects Affecting Maize.

Among the insects injuring maize, *Cirphis ? phaea* Hmp. («rami-rami») occurs in several localities in the Colony. Its larvae appear in swarms and do not leave a trace of grass or maize behind them. The maize replanted after the visitation of the caterpillars does not stand a good chance of succeeding, because of weather conditions. The control of this pest demands vigilance; as soon as the young caterpillars are detected, burning the grass or bush round the fields and lawns will destroy large numbers of them. Caterpillars which appear on the maize can only be prevented from doing extensive damage by spraying. Other injurious insects are *Calamistes praepallens* Hmp. and *C. fusca* Hmp., the caterpillars of which bore into the maize stems and frequent the flowers also, and Noctuid caterpillars of a species not yet determined; the latter bore into the seeds and destroy them, causing much injury; on account of their numbers, size and voracity they are undoubtedly the worst maize pest. The beetles *Lagria villosa* F. and *L. viridipennis* F., and the locust *Zonocerus variegatus* L., are general leaf-eaters which also frequently damage maize.

In order to free stored grain from *Calandra oryzae* L., *Tribolium castaneum* L., *Laemophloeus pusillus* Schön. and *Silvanus surinamensis* L., the natives use very primitive and imperfect methods of disinfection (heat and smoke), and it is very difficult to popularise modern efficient methods of fumigation.

Insects affecting Yams. — The following are mentioned by the writer: *Prionoryctes caniculus*, Arrow., *Crioceris livida* Dalm., *Apomecyna parumpunctata* Chev., *Lagria villosa* F., *L. viridipennis* F. and *Zonocerus variegatus*.

Insects affecting Funtumia Rubber. — *Glyphodes ocellata* Hmp., *Nephele aequivalens* Walk., *Thermopteryx elasticella* Hmp. and *Physothrips funtumiae* Bagn.

Insects affecting Para Rubber. — Larvae and insects have been found boring into these plants.

Insects affecting Mahogany. — Mahogany trees (*Khaya senegalensis*) at Calabar have suffered severely from the attacks of wood-boring lepidopterous larvae, probably Cossidae, which bore holes into the trunk and branches. Another lepidopterous larva and a nocturnal cricket, possibly *Brachytrypes*, injure these trees.

Insects affecting Arabian Coffee. — The following insects were found upon coffee: *Ootheca mutabilis* Sahlb., *Antestia variegata* Thumb., *Riptortus tenuicornis* Dall. and *Dictyopharina serena* Stål.

Insects affecting other plants. — *Rhynchophorus phoenicis* F., on the oil palm; *Temnoschoita quadrimaculata* Gyl. and *Archon centaurus* Burm. on coconut palm; *Adoretus hirtellus* Castn. on kola; *Cosmophila erosa, Zebronia phenice, Dysdercus superstitiosus* and *Oxycarenus dudgeoni* on Okra (*Hibiscus esculentus*); *Lagria villosa* F., *L. viridipennis* F., *Monolepta* sp., *Zonocerus variegatus* F., *Azazia irrorata* F. have been observed upon the cowpea, and *Apate terrebrans* Pall. upon *Poinciana regia*.

MEANS OF PREVENTION AND CONTROL.

392 - **Arsenite of Zinc as an Insecticide.** — SCHOENE, W. G. in *New York Agricultural Experiment Station, Technical Bulletin*, No. 28, pp. 1-16. Geneva, N. Y., 1913.

The writer gives the results of a series of experiments on the determination of the toxicity to insects of zinc arsenite and lead arsenate, and the resistance of leaves to zinc arsenite. In this respect 1 lb. of arsenite of zinc is equivalent to 3 lbs. of arsenate of lead. The addition of slaked lime or Bordeaux mixture to the zinc arsenite prevents any damage to apple foliage, but when it is used alone, or with lime-sulphur wash or glucose, it causes more or less spotting of the leaves. Arsenite of zinc, either alone or mixed with glucose, causes severe scorching of the leaves of the vine. Laboratory experiments show that the damage caused by arsenite of zinc is partly due to its solubility in carbonic acid. The contradictory results obtained with this insecticide are presumably due to the lack of uniformity in its manufacture. Arsenite of zinc and arsenate of lead mixed with either Bordeaux mixture, soap or glue retain their activity for 25 days. Applied alone or with glucose they gradually lose their poisonous properties on exposure to the weather, and at the end of 25 days cease to protect the foliage. Lime-sulphur wash does not appear to resist moisture as well as Bordeaux mixture.

393 - **Destruction of Locusts in Turkestan.** — *Communicated by* JOS. P. BARSACQ, *Commissioner in Russia for the French Ministry of Agriculture.*

From the earliest times, locusts have always been the most serious pests of agriculture in Central Asia; formerly the inhabitants, for religious reasons, did hardly anything to check their periodic invasions, but since the conquest of Turkestan the Russians have paid considerable attention to them, though it is only within the last few years that a methodical campaign against these dangerous enemies has been organized. If one considers that Turkestan furnishes Russia with almost half the cotton used in her mills (or about 120 000 tons), and that cotton suffered most from the repeated attacks of locusts, it will be readily understood that the Russian Government has every interest in ensuring the free development of this important crop. Further, Turkestan is still almost without rapid means of communication, and consequently has to depend on its own production of cereals, so that the protection of the cultivated land from the more or less frequent attacks of locusts had become urgent.

The fauna of Turkestan includes a number of species of locusts, but they are not all equally harmful. The first place is certainly taken by the Marocco locust (*Stauronotus maroccanus*), which prefers uncultivated arid plains for its egg-laying. The permanent area of distribution of this species comprises the steppes of Samarkhand, the Khanat of Bokhara, and Afghistan; it is not rare to find important egg-laying centres in various parts of Turkestan, but they cannot be considered as anything but temporary. The Marocco locust lays eggs up to nearly 2000 m. (6600 ft.) above sea-level; sometimes the density of eggs reaches 10 000 clusters per square yard; each egg-laying centre usually occupies some hundreds of acres, but may run into thousands. In normal seasons hatching takes place between the 2nd and 10th of April, lasting 7 to 10 days. The date and duration of hatching are, however, much influenced by the altitude, the position of the centres, the temperature and nature of the soil, and the rainfall. The larval period lasts from 35 to 50 days, during which time the voracity of the insect constantly increases. An idea of the enormous damaged caused by this species to the crops in Turkestan may be had from the table given below.

The migratory locust (*Pachytylus migratorius*) possesses several permanent areas of distribution in Central Asia, including the reed-beds along the banks and in the deltas of the rivers Sir-Darya, Amu-Darya, Zarivachan, Ili and Tchou. This species rarely damages crops, preferring the shoots of the reeds which occur in abundance near the egg-laying areas. At the same time official data for 1896 speak of 75 000 acres of various crops dammaged by this species, possibly assisted by the nearly related *P. danicus*; in recent years it has confined itself to uncultivated places, and no serious complaints as to damage done by it have been received.

The Italian locust (*Caloptenus italicus*) is a common species in Turkestan, but till recently only caused insignificant damage. This appears to have been due to considerable destruction by natural enemies. Recent observations also show that it is almost always starved out by the more voracious Marocco locust; an interesting fact is that in regions in which the Marocco locusts were completely exterminated two or three years ago, *Caloptenus* is now increasing to an alarming extent, and occurs in numbers unknown before the disappearance of *Stauronotus*.

The following locusts are also known as injurious in Turkestan, though not to the same extent as other species: *Oedalus nigrofasciatus* Deg., *Stetophyma* (*Arcyptera* Serv.) *flavicosta* Fisch., *Arcyptera* (*Pallasiella* Kirby) *truchmanna* Fisch-Waldh., *Acridium* (*Orthacanthracis* Karsch) *aegypticum* L., *Stauronotus kraussi*, *S. tartarus*, *S. anatolicus* and *S. brevicollis*.

DESTRUCTION OF LOCUSTS.

All the known means of destruction of locusts have been tried in Turkestan; the following is a brief summary of the work.

A) MECHANICAL MEANS:

1) Collecting and destroying the egg-clusters was carried out on a large scale for several years, but with next to no results, for the locusts

appeared in quantities at all the egg-laying centres and did enormous damage (amounting to nearly half a million sterling, according to the official figures). This laborious and irrational method has been definitely abandoned.

2) Destruction of eggs by ploughing under has given no decisive results.

3) Flooding of the eggs is a radical remedy, but unfortunately is only applicable on continuous areas with a plentiful water supply.

4) Crushing the larvae by wooden or iron rollers made extra heavy by loads of earth stones, etc., and sometimes with thorny twigs drawn behind, has been practised with success in some parts of Turkestan. It seems, however, to be a rather cumbersome method.

5) Collecting the larvae in sheets has hardly been practised on a large scale except in the Ferghana region: it has been given up as not convenient.

6) Catching the larvae in pits or ditches dug near the swarms or in the way of moving columns of larvae has long been carried out in all parts of the country; pits are only used in the case of large swarms on a limited area. The destruction of columns of large locusts has also been attempted by the use of barriers similar to those used in Cyprus and Durand's apparatus; the canvas was replaced by rolls of old sheet-iron 12 to 14 inches high, held up by short stakes. This is very effective, but is costly to put up. Ditches are excavated in the line of march of travelling columns of locusts and are dug 2 to 3 ft. deep and the same in width, generally with vertical sides; at intervals along the bottom holes are dug out 14 to 20 inches deeper, for the larvae to collect in. Circular trenches may also be dug round very dense egg areas before the larvae hatch out, but these are very expensive and are not infrequently made useless by the destruction of the egg-clusters by insects or fungi.

7) "Fishing" of locusts in streams and irrigation canals is practised when other means for stopping the moving columns have failed. But as suitable watercourses rarely occur in the track of the columns, this method is of limited value, especially as the destruction is by no means perfect.

8) Destroying the larvae by fire is carried out on a large scale in Turkestan. The method at present used is scorching by means of a special knapsack apparatus; the petroleum flare of this can be turned on to the larvae in various directions with very little loss of heat. Several systems were tried (Siédoff, Schkilin Bildin, etc)., and the Schkilin apparatus was found to give the best flame. This method, however, comes rather expensive, and is only justifiable on irregular land free from grass and without streams or other supply of water. Large machines on the same principle have also been tried, but they have not given good results in practice.

B. Chemical means. — a) *Internal poisons.*

1) Spraying for locusts with Paris green has been tried on a large scale and has given excellent results. The best strengths have been found to be: up to the 3rd moult of the larvae, 4lbs. Paris green and 8lbs. lime in

100 gallons of water; later 5 ¼ lbs. Paris green and 10 ½ lbs. lime to 100 gall.; and when the larvae are threatening the cultivated land the strength is increased to 8 lbs. Paris green with 10 ½ lbs. lime. About 24 gallons of spray are required to treat an acre. The total expense (apparatus, insecticide, labour, etc.) comes to about £ 3 3*s* 6*d* for a day's work, in which about 27 ½ acres would be treated, making about 2*s* 4*d* per acre. In spite of the cheapness of Paris green spraying, it has several drawbacks: the spray is easily washed off by rain or dew, so that spraying may have to be repeated; it can only be used where the ground is covered by vegetation; the lime for making the mixture may not be obtainable near at hand, and does not keep well; the Paris green does not affect the larvae till about the third day, so that the effect cannot be ascertained at once, and washing off by rain may not be noticed. The following table shows the area treated with Paris green (at the expense of the State) during the last few years, and the number of large machines used:

Year *	1902	1903	1904	1905	1907	1909	1910	1911
Area treated **, acres	121 259	137 084	147 023	93 335	11 342	8 308	124 442	196 710
Paris green used, lbs.	148 390	191 410	198 640	106 710	19 254	13 885	195 860	286 840
No. of large machines working	110	136	136	141	48	30	238	404

* No treatment in 1906 and 1908. — ** Treatment lasts 21 to 26 days per year.

To prevent the mixture being washed off by rain, an attempt has been made to use molasses instead of lime; this has the further advantage of being attractive to the locusts. The molasses is used in double the amount for lime, the Paris green remaining the same; when molasses can be obtained cheaply, this mixture should be preferred, as it gives excellent results.

2) Ammonium arsenite, obtained by treating Paris green with ammonia, has been tried in Turkestan at the suggestion of Schreiner (1911), whose formula is the following: Paris green, 1.2 lbs.; liquid ammonia at 22°, 1.8 lb.; brown molasses, 10 lbs.; water, 30 gallons. This mixture has some marked disadvantages, not compensated for by its quick action and adhesive properties. Commercial ammonium arsenite has not been tried.

3) Barium chloride in 4 per cent. solution has given excellent results. This insecticide is easy to prepare, is less dangerous for the men and does not clog the nozzles; but it is much too dear, is easily washed off by rain, and does not show up on the sprayed plants.

4) Sodium arsenite, long used in South Africa, was first tried in Turkestan in 1911; it was so successful that it is now the only substance used on a large scale. The best strengths for the different stages of the larvae are as follows: 1st and 2nd stages, 0.25 per cent; 3rd stage, 0.37-0.4 per cent.; 4th stage, 0.5 per cent. Perfect adhesiveness is obtained by adding double the amount of mollasses (brown sugar) in each case. Thus prepared, the insecticide is not readily washed off by rain and acts on the larvae in an astonishing way: a mortality of 100 per cent. is obtained in the 24 hours following the application. Sodium arsenite comes cheaper than Paris

green, gives a higher mortality, acts more quickly, sticks to the plants better (used with molasses), and is easier to apply; on the other hand, it scorches the vegetation and is more dangerous to handle, but these slight disadvantages are not enough to outweigh the advantages mentioned.

5) Other arsenical compounds, soluble and insoluble, tried in Turkestan, have not given decisive results.

b) *Contact washes.* — These have also been tried, but without much success; in particular soft soap solutions at 3.3 per cent. were recommended by some entomologists, such as Rossikof and Schreiner; experiments on a large scale have shown that they are not reliable. Contact washes present no advantage over scorching. Various other insecticides, like ordinary soap, paraffin emulsion and certain complicated mixtures, have given no better results.

c) *Hopper dodgers.* — These machines, successfully used in America, Australia and Russia, have been tried in Turkestan. They consist of large plates of wood, sheet-iron or canvas, drawn by horses, and smeared with petroleum or bitumen; the larvae jumping out of the way fall onto these plates and are caught by the sticky material. Hopper-dodgers are only useful for the destruction of small colonies of locusts, as they do not catch enough to deal with the large invasions frequent in Turkestan. Further, they can only be used in perfectly level places free from vegetation.

This study of all the methods tried on a large scale in Turkestan allows one to select the most convenient and advantageous for each particular case. The Russian entomologists in charge of the work of destruction in this vast region at present use the plan detailed below; they have succeeded in reducing the enormous damage caused by locusts to almost nothing. Turkestan has been almost completely freed from these dangerous pests, and since 1911 the work has been largely confined to exterminating certain centres of small importance which appear here and there near the frontiers of Persia and Afghanistan. The plan is as follows: 1) preparation in summer and autumn of forecast maps, showing the position area and density of the egg centres of each district; 2) treatment of the infested area with Paris green, or better, molassed sodium arsenite, as soon as the larvae appear; 3) scorching by knapsack machines of larvae in places not accessible to sprayers, devoid of vegetation or far from watercourses of sufficient capacityto keep the sprayers going regularly; 4) capture of larvae in pits or ditches.

NATURAL ENEMIES OF LOCUSTS.

Among birds, the chief locust-destroyer in Turkestan is the rose-coloured starling (*Pastor roseus*); these birds nest in the mountains and come down in enormous flocks to follows the colums of larvae, as well as the flights of adults, which they often kill on the wing in large quantities. This species is undoubtedly a precious ally, but in regions of organized control it often complicates the work; it would therefore be risky and unreasonable to rely on regular assistance from these birds, and especially to include such an in-

constant element in the plans for destruction. The sparrow also hunts locusts, and some writers believe that, like the pastor, it destroys the larvae simply for the pleasure of killing them. Ravens and crows take chiefly the eggs, which they dig out of the ground in late summer and autumn; they are made use of by the entomologists to discover the chief centres of egg-laying for indication on the forecast maps. The destruction of eggs by crows is in some regions helped by certain species of lizards, of the genera *Eremias* and *Phrynocephalus*.

Entomophagous insects attacking locusts are few in number in Turkestan. Among predatory ones may be mentioned certain species of *Callistenes*, which devour the larvae, and *Prosodes*, *Adesmia*, *Stalagmoptera* and certain Elaterids (? *Athous*), which feed on the egg-clusters. The true parasites develop in the eggs, the larvae or the adults. It has been found that species of locusts inhabiting districts with rich vegetation suffer more from the attacks of parasites than those which pass several stages of their development in districts where vegetation is scanty.

The Marocco locust in Turkestan is attacked almost exclusively by endophagous parasites, among which *Callostoma desertorum* is the most important; then come its near ally *Mullio obscurus* F., and a Meloid, *Zonabris 4-punctata*. The larvae bore into the egg-cases immediately after laying, and undergo all their metamorphoses there. They are very numerous in places frequented by the locusts several years in succession; the larvae of *Callostoma* and *Mullio* alone may destroy 40 per cent. of the eggs, while those of *Zonabris* account for hardly 2 per cent.

The egg-clusters of the Marocco locust are also subject to attacks of certain fungi not yet properly studied; these may reduce considerably the number of larvae hatching. The introduction of the fungi is evidently assisted by the attacks of birds and is favoured by moisture in the soil; they are so important that account has to be taken of them in drawing up the plan of campaign: when the forecast maps are prepared, it is customary to note the degree of infection of the eggs by animal parasites, but the fungi may so much alter the situation during the winter and in early spring, that centres very rich in autumn may give no hatching in spring. Miscalculations of this sort have not infrequently arisen, and in such cases parties sent to the places at great expense were kept idly waiting for the eggs to hatch for several weeks, when they might have been carrying out useful work in districts really in danger. For the forecast maps to provide reliable information, and thus to fulfil their purpose, it would be necessary to verify the state of the eggs in the spring before hatching began and make careful notes of the centres no longer dangerous; in this way much annoyance and useless expenditure would be avoided.

The importance of the natural enemies, in particular the endophagous parasites, cannot be doubted; it is certainly to them that must be attributed the almost complete disappearance of the locusts in certain years. But the value of this factor must not be exagerated in arranging the plan of destruction, for the conditions of development of these organisms are as yet little understood, and a large multiplication of them only takes place after re-

peated invasions of the locusts in a particular area. It is evident that the exigencies of modern agriculture are not compatible with such a state of affairs, for the simple reason that before the appearance of the parasites the crops will be devastated several times ; it is much more logical and easy to get rid of these dangerous enemies as soon as they appear than to count on the assistance of an element so vague and inconstant as the natural enemies.

Breeding of parasites on a large scale with a view to their utilization for destroying locusts, has not been attempted in Turkestan. Last year experiments were made with *Coccobacillus Acridiorum* d'Hérelle; when administered after passage through locust hosts it gave a heavy mortality, but contaminated grass gave no decisive results. This method is still being studied.

Economic Importance of Locusts in Turkestan.

We have already remarked on the special reasons for protecting the crops in Turkestan from locusts. The figures given in the accompanying table show the importance of the damage, the loss to the local population, the sums expended by the Locust Control Administration, and the results obtained.

Losses due to locusts in Turkestan.

Year	Area of egg-laying centres — acres	Area of crop destroyed — acres	Estimated value of crops destroyed — francs	Days of labour required for the control	Total loss to the population — francs	Expenditure for the control — francs
1901	54 793	344 981	7 853 300	2 905 778	11 480 975	114 250
1902	184 668	259 060	5 895 000	5 054 789	12 217 350	509 875
1903	179 034	126 280	2 872 500	1 714 857	5 018 082	435 140
1904	259 426	59 238	1 348 437	1 470 276	3 186 280	417 212
1905	114 357	23 414	534 000	601 333	1 284 790	601 964
1906	42 543	0	0	0	0	468 887
1907	20 239	702	insignificant	0	insignificant	130 700
1908	25 428	4 112	106 125	419 295	811 080	27 500
1909	55 764	58 776	1 337 925	592 000	2 077 385	200 000
1910	226 233	8 451	217 375	391 175	706 342	1 198 412
1911	218 531	0	insignificant	0	insignificant	1 446 547
1912	0	0	0	0	0	?

INSECTS INJURIOUS TO VARIOUS CROPS.

394 – **Insects in Flour Mills and Granaries.** — Dean, George A. in *Kansas State Agricultural College, Agricultural Experiment Station Bulletin*, No. 189, pp. 139-236, figs. 1-56. Manhattan, Kansas, 1913.

The writer describes numerous experiments on the cleansing of mills from injurious insects by means of high temperatures, and discusses another series of experiments on the destruction of insects infesting flour and stored

grains by means of fumigation with hydrocyanic acid gas and carbon disulphide. The damage caused by insects to stored grain in the U. S. A. amounts to 5 per cent. of its value.

Lack of supervision and cleanliness are the causes of the large increase of insects in mills and granaries. It is very important to sweep up all the waste flour from the floors, corners, under machines, etc. The application of high temperatures is the only efficacious and practical method so far known for destroying these insects. This method has developed to such an extent of recent years that it seems likely to revolutionise the comparatively inefficient methods at present in use. The heating of various mills in Kansas has given absolute proof that these insects cannot resist the heat in any of their stages, even in the most inaccessible places. This system has also been employed with success in several mills in Ohio, Illinois, Nebraska, Iowa, Indiana, the south of Canada, etc. The heat penetrates throughout, through obstacles and into the remotest corners where gases could not reach the insects. Many insects can resist the effects of hydrocyanic acid for a long time, but none can resist a temperature of 118 to 122° F. for even a short time. Fumigation with hydrocyanic acid requires 2 or 3 days, thus involving considerable expense in the long closing of the mill and the cost of the necessary material, not to speak of the danger to the operators. If the heating system is applied from Saturday to Monday morning no time is lost, the cost is small and there is no danger to the operators. In a mill which can be warmed to a temperature of 70° F. in winter, it is easy to obtain a temperature of 118 to 122° in summer. By this method no damage is done to the flour, the belting or machinery, and there is no danger of fire. It is recommended by the " Mutual Fire Prevention Bureau ", which represents eight of the principal millers' assurance companies.

Mills infested by *Ephestia kuehniella* Zell. (Mediterranean Flour Moth) may be effectively treated with hydrocyanic acid, but this method is not recommended if the heating system can be applied.

The simplest, the most effective and the least costly remedy against insects infesting grains and their products stored in warehouses is careful fumigation with carbon disulphide. In well closed buildings in which the temperature is about 70° F., 4 ½ lbs. of carbon disulphide is sufficient for about 1000 cu. ft., and about 1 lb. for every ton of grain. It is not an effective disinfectant for flour mills, and for such places is not recommended owing to the danger of fire.

395 – **The Florida Fern Caterpiller *(Eriopus floridensis)* in the United States.** — CHITTENDEN, F. H. in *U. S. Department of Agriculture, Bureau of Entomology, Bulletin* No. 125, pp. 11, 1 fig. Washington, 1913.

During recent years a considerable number of caterpillars of *Eriopus floridensis* Guén. have appeared in the District of Columbia, in Illinois and in Ohio. The insect is indigenous to Florida and Tropical America. It has caused serious damage to ferns growing under glass.

The writer describes the life-history of the insect. The eggs and the early larval stages have not been observed. The larvae feed chiefly dur-

ing the night, resting at the base of the plant during the day-time. They cause serious damage to ferns at all seasons of the year. The cocoons are attached to fragments of leaves and other soil rubbish, near the level of the ground. The pupal stage lasts from 23 to 27 days.

Some of the natural enemies of the insect are *Ichneumon extremalis* Cress, *Sargaritis* sp. and a Tachnid not identified.

As means of controlling this insect, a decoction of hellebore, poisoned baits and carbon disulphide have given good results. Arsenate of lead would be effective, but it reduces the value of the plants by covering them with a white layer. The best method is hand picking the larvae which fall to the ground when the plants are shaken. Fumigation with hydrocyanic acid has not been much used, but should give effective results.

396 - **The Rose Slug-Caterpillar *(Euclea indetermina)* in the United States.** — CHITTENDEN, F. H. — *U. S. Department of Agriculture, Bureau of Entomology, Bulletin* No. 124, 9 pp., 1 fig. Washington, 1913.

It is only within recent years that the slug-like caterpillar of *Euclea indetermina* has been known to injure the rose. It has already been observed on plum, oak, chestnut, hiccory (*Carya*), pawpaw (*Asimina triloba*), bayberry (*Myrica cerifera*), flowering dogwood (*Cornus florida*), apple pear, wild cherry (*Prunus* spp.).

All writers seem to agree in stating that the larvae mature during September, but the specimens which were received from West Virginia had matured by August 20.

Eggs are deposited during July, in small groups slightly imbrecating or overlapping, and hatch in about nine days. The larvae pass through eight stages, and occasionally nine, before transforming to pupae, and it has been observed that in stage I, which is passed rapidly, they take no nourishment. The species hibernates in its cocoon, and the moth has generally been observed to issue in July.

In case only a few rose bushes or young trees are attacked, hand-picking is ample for controlling this insect, the precaution being taken to use a glove, thus avoiding being " stung ". Should the caterpillars appear on several plants, they should be sprayed with Paris green or arsenate of lead.

397 - **Diptera injurious to Cabbages.** — SCHWARTZ, MARTIN in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XIX, Part 7, pp. 98-100, figs. 1-2. Berlin, February 14, 1914.

The writer refers to all the Diptera injurious to garden crops, and deals specially with those attacking cabbages : *Chortophila brassicae, Anthomyia floralis, A. radicum, Phaonia trimaculata.*

For the control of *Chortophila brassicae,* chemical substances have not yet given good results. The chief preventive measure is careful examination of the young plants before setting out and elimination of all showing infection. A second examination should be made within a fortnight, and all attacked plants should be destroyed ; before replanting, the vacant spots should be well beaten down and treated with insecticide, to destroy any larvae in the ground. In this way the first generation can be got rid off.

Another important point is to burn the stalks after the cabbages are cut. Fresh manure should not be used. Seedlings grown in frames should be covered with netting to keep off the flies.

398 – **The Grape Leaf-Hopper *(Typhlocyba comes)* in New York State.** — HARTZELL, F. Z. in *New York Agricultural Experiment Station, Bulletin* No. 359, pp. 31-51, figs. 1-3, plates I-VI. Geneva. N. Y., 1913.

A large number of adults of *Typhlocyba comes* Say. survived the winter of 1911-12 and threatened many vineyards, but fortunately weather conditions during the summer were unfavourable for the nymphs, causing a decrease of the insects during the late summer and autumn of 1912.

The most favourable hibernating places for the leaf-hopper are fence rows, woods, brush and waste land, weeds and places where leaves accumulate. The drier, well-drained soils are more conducive to the safe wintering of the adults than the heavier soils. The foliage of raspberry, strawberry, blackberry, currant, gooseberry, catnip (*Nepeta Cataria*), Virginia creeper, burdock, beech and sugar maple is eaten by the hopper before it migrates to the foliage of the grape. The strawberry and raspberry are the favourite spring food-plants, the insect migrating from the strawberry to the raspberry during early May and from the raspberry to the grape during the latter part of May.

Mating of the hibernated adults takes place on the spring food-plants. The foliage of the grape is injured by the overwintering adults, but most of the feeding is restricted to the lower leaves, especially those of the young shoots or suckers at the base of the vine. The amount of injury to vineyards varies directly with their proximity to favourable hibernating places and spring food-plants.

Spraying experiments during 1912 showed that a solution of 1 part of 40 per cent. nicotine (" Black leaf 40 ") in 1600 parts of water or Bordeaux mixture is an efficient spray for the leaf-hopper. The fruit from vines protected from the leaf-hopper is superior to fruit from vines subjected to the attacks of this pest. Chemical analyses of grapes from sprayed vines gave a gain of from 8 to 68 per cent. in sugar over those from untreated vines, while the unsprayed grapes had from 0 to 20.6 per cent. more acid than sprayed grapes.

The destruction of hibernating places of the grape leaf-hopper is recommended as a method of control, especially to save the young foliage of the grape in the spring. When hibernating adults are on the young foliage, delaying the removal of the young shoots at the base of the vine will tend to keep the insects on the lower leaves and thus afford some protection to the more permanent foliage. The lower shoots should be removed just previous to spraying.

399 – **The Control of the Codling Moth in the Sacramento Valley, California.** — WOODWORTH, C. W. in *University of California, College of Agriculture, Agricultural Experiment Station, Berkeley, Circular* No. 101. 4 pp., 3 figs. Berkeley, June 1913.

In contrast with the conditions prevailing in the Pajaro Valley, codling moths appear in the Sacramento Valley early in spring and are ready to begin egg-laying before the fall of the blossoms of the apple and pear. Egg

laying is concluded in about a month. The eggs hatch in about 8 ½ days and the young larvae are abundant in the apples by the time they are as large as peas; they remain in them for about 27 days. The pupal stage lasts a month, and the moths are out by the middle or latter part of July.

A second generation occurs during August and September, and a few of the more precocious are able to produce a third generation in the autumn. Usually the worms of the second generation go into hibernation as soon as they have spun their cocoons and do not transform till the following spring.

Most of the apples grown in the Sacramento Valley are early fruit, which is ready to harvest early enough to escape the attack of the second brood of worms. Where nothing is done to protect the fruit the worms injure two-thirds of the crops. If the orchard were isolated and all the fruit removed at this time, the second generation might be largely annihilated by starvation.

Pears are more largely grown in the Sacramento Valley than apples, and are not usually seriously affected by the first brood of worms (less than 10 per cent.), but if not controlled the worms of the second generation injure a third of the crop. The usual method of harvesting pears removes the larger proportion of the worms of this second generation from the orchard; hence the relatively small injury from the first generation of the following year.

The gathering and destruction of fallen fruit was formerly required by law in California. Twenty years ago the placing of bands of old grain sacks round the trunk and examining them once a week or once a fortnight was found more effective. A parasitic wasp imported from Spain was found to be of no practical value.

The use of arsenical poisons has come to be the sole method for the control of this insect. All who have investigated the subject agree that the poison must be applied before the worms enter the fruit, and a thorough application is necessary for the best results. Both the life history and observations of the results of practical spraying work indicate that the time for the first application in that valley is as soon as possible after the petals fall.

In the case of pears or autumn apples, unless this first spraying has been very thorough, the second brood will require attention during the latter part of July or early in August. For this purpose the placing of bands of sacking about a few of the trees is recommended, and these should be examined about the 1st and 15th of July and August.

One thorough spraying for summer apples and one or two for autumn apples and pears will completely control the codling moth in the Sacramento Valley. The writer gives the following formula for an orchard of about ¼ acre of average-sized trees :

Lead arsenate.	3-6 lbs.
Water.	100 gallons.

Zinc arsenite may be substituted for arsenate of lead, using about one-third as much (1-2 lbs. for 100 galls. of water), or Paris green (3/4-1 ½ lb. in

100 galls). In the latter case it is usual to add about three times as much lime. This serves two purposes, holding the arsenical poison on the tree and marking the tree so that one can be sure of the thoroughness of the application.

400 - **Small Ermine Moths *(Hyponomeuta malinella* and *H. padella)* in the United States.** — SCHOENE, W. J. and PARROT, P. J. in *New York Agricultural Experiment Station, Technical Bulletin*, No. 24, 40 pp., 10 figs, map, 9 plates. Geneva, N. Y., 1913.

Hyponomeuta malinella and *H. padella* were found in numbers in the State of New York in 1909, probably imported on infected stock. They are now found in many districts, *H. malinella* on apples and *H. padella* on whitethorn and plums.

In the Unites States the moths appear in the first fortnight of July, and egg-laying begins about the middle of the month. The larvae, after hibernation, feed till the second half of June, and then pupate.

These species seem to be largely free from the numerous parasites which attack them in Europe ; but an Ichneumonid (*Mesochorus* sp.) has been bred from *H. padella* on cherry, while a Tachinid (*Exorista arvicola* Meigen) has been found abundant in some colonies of *H. malinella*.

The chief means of control are careful inspection of nursery stock in June, and arsenical spraying.

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